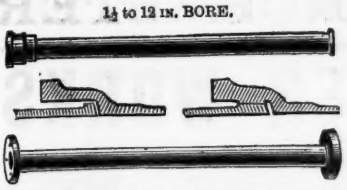
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVI. No. 1686.] LONDON, SEPTEMBER 3, 1895. [47TH YEAR. PRICE 6d.

GAS AND WATER PIPES

½ to 12 IN. BORE.



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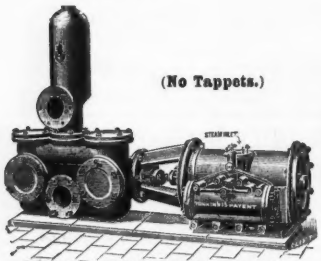

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Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

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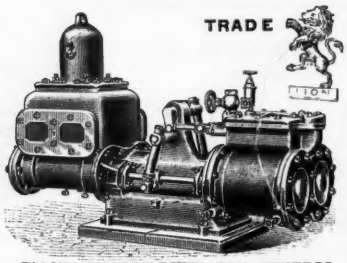

Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

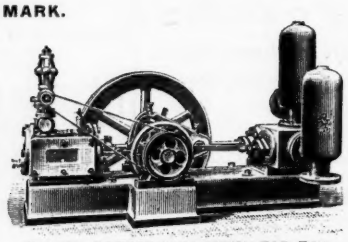

Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

Fig. 705. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

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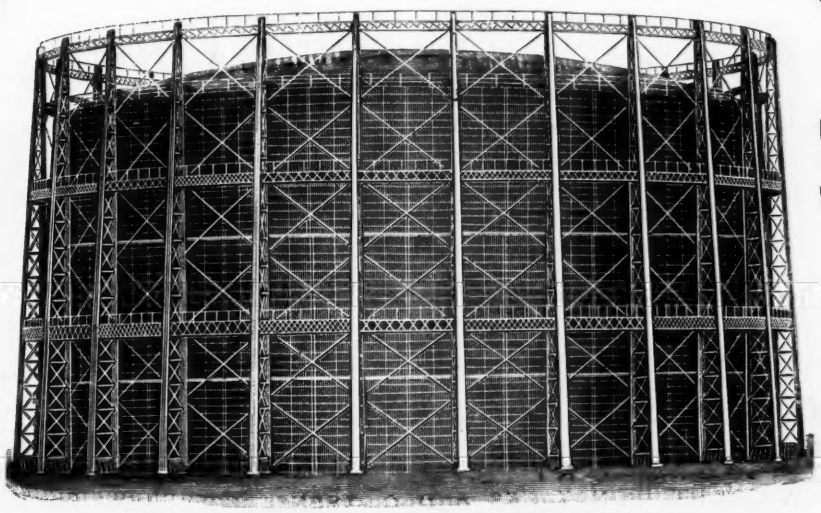

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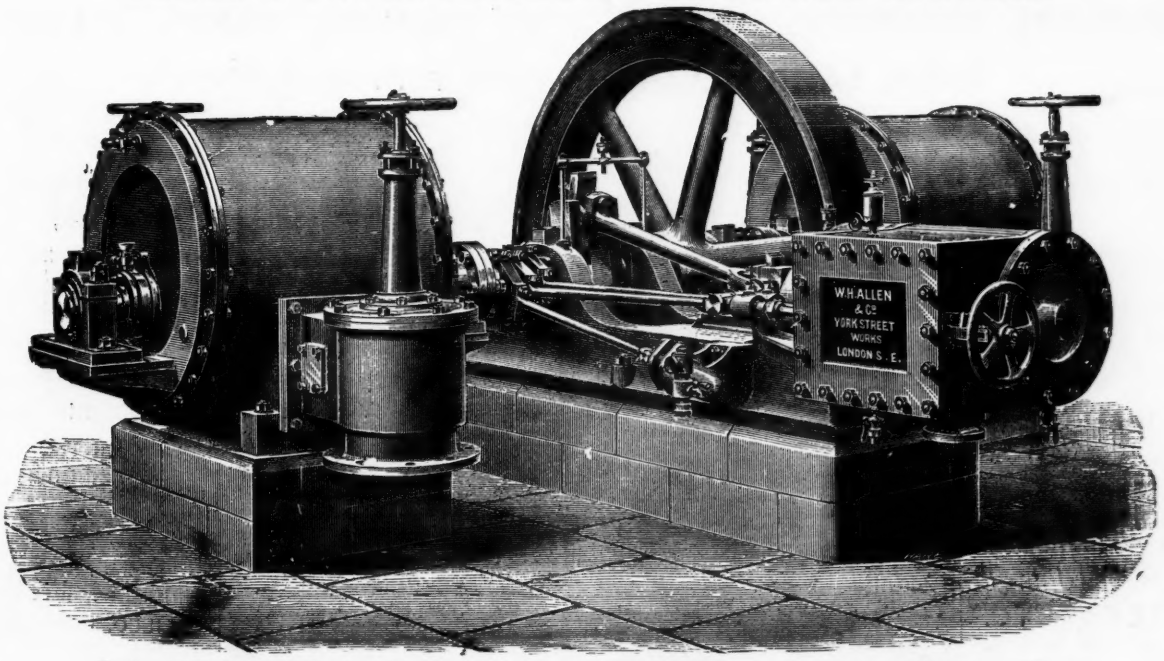

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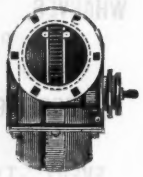

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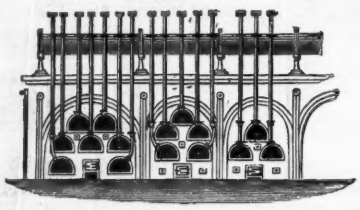

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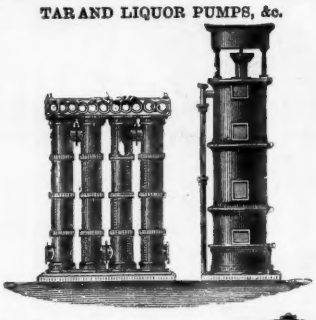

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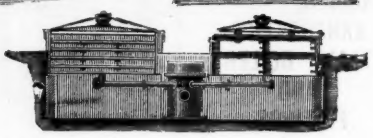

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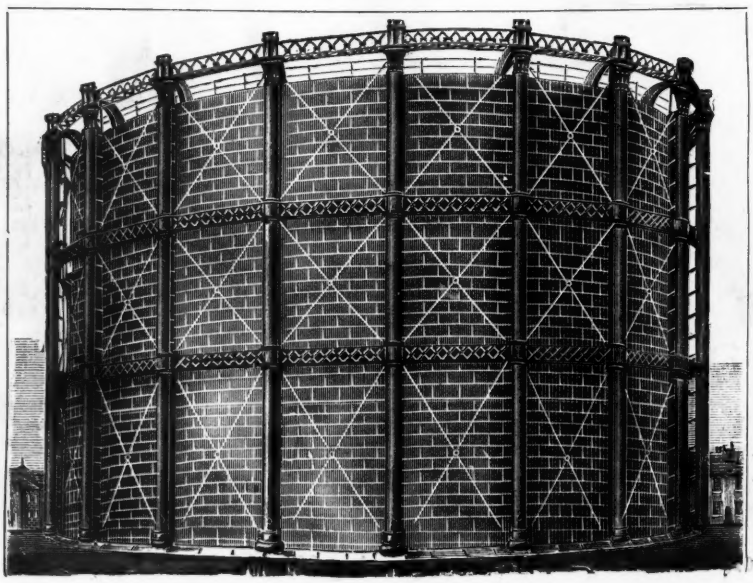

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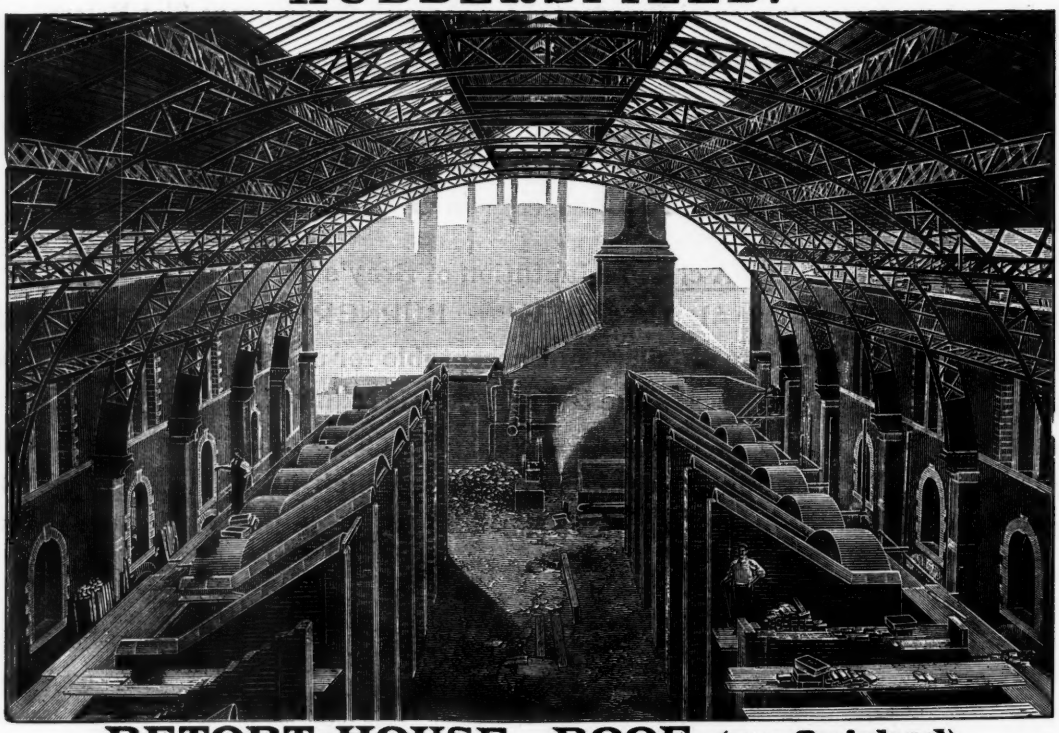

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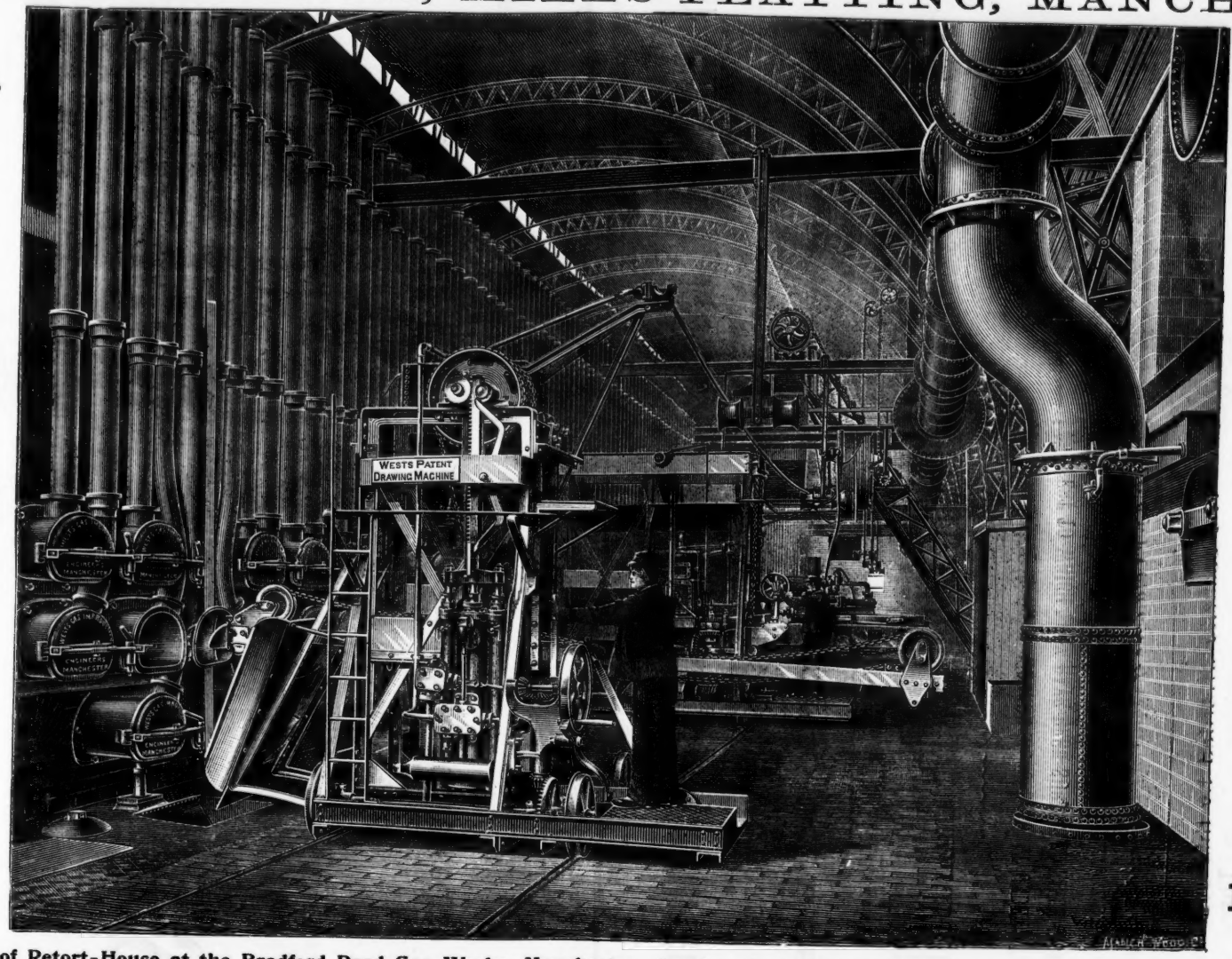

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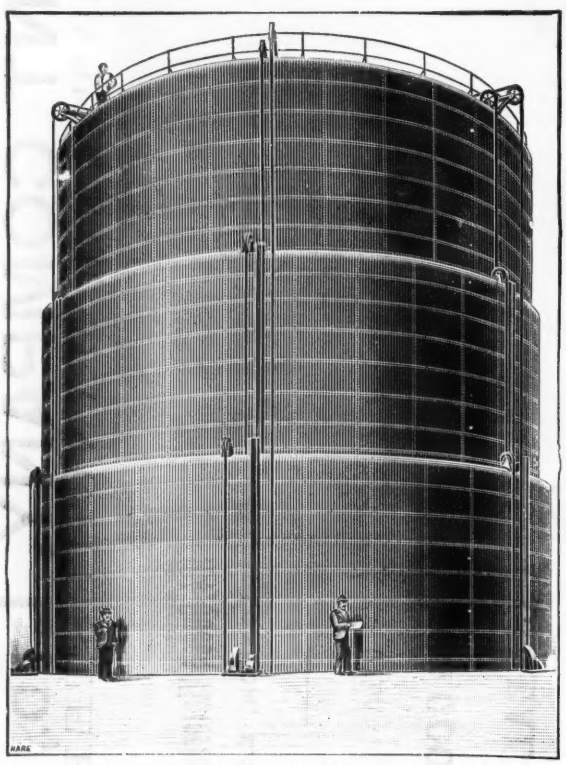

From Photo. of Three-Lift Roped Holder, 50 feet diameter by 18 feet deep each Lift. Erected at Sligo, 1894.

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Pease's Patent Roped Gasholders

THESE HOLDERS HAVE WORKED SUCCESSFULLY UNDER EVERY TEST TO WHICH THEY HAVE BEEN SUBJECTED SINCE 1889.

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Send for Catalogue if requiring increased Storage.

The security afforded by this System is shown by the working of the Three-Lift Holder, the subject of this engraving; not only was the Holder unaffected by the recent heavy gales, but also the recorded strain on the Ropes was remarkably small.

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INCANDESCENT GAS-LIGHT

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The estimated quantity of gas that would have been consumed by the 10-feet flat-flame burner was 11,678 cubic feet. The actual quantity of gas used by the Incandescent Gas-Light Company's Burners, as recorded by the meters, was 4415 cubic feet.

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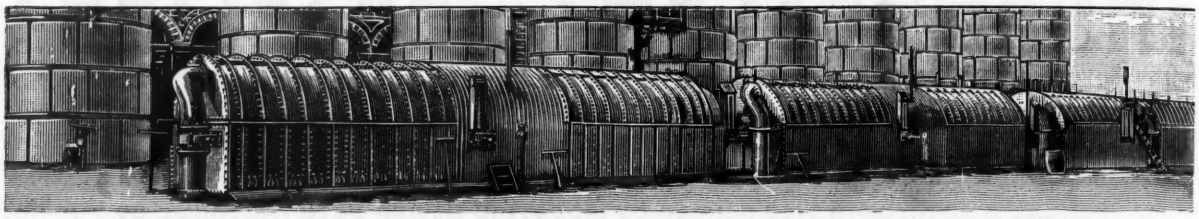
☛ **502** of these Machines (capable of dealing with **488,800,000** cubic feet of Gas daily) in use and in course of construction, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have 30 of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

MARSHALL'S PATENT BATTERY CONDENSER & SCRUBBER.

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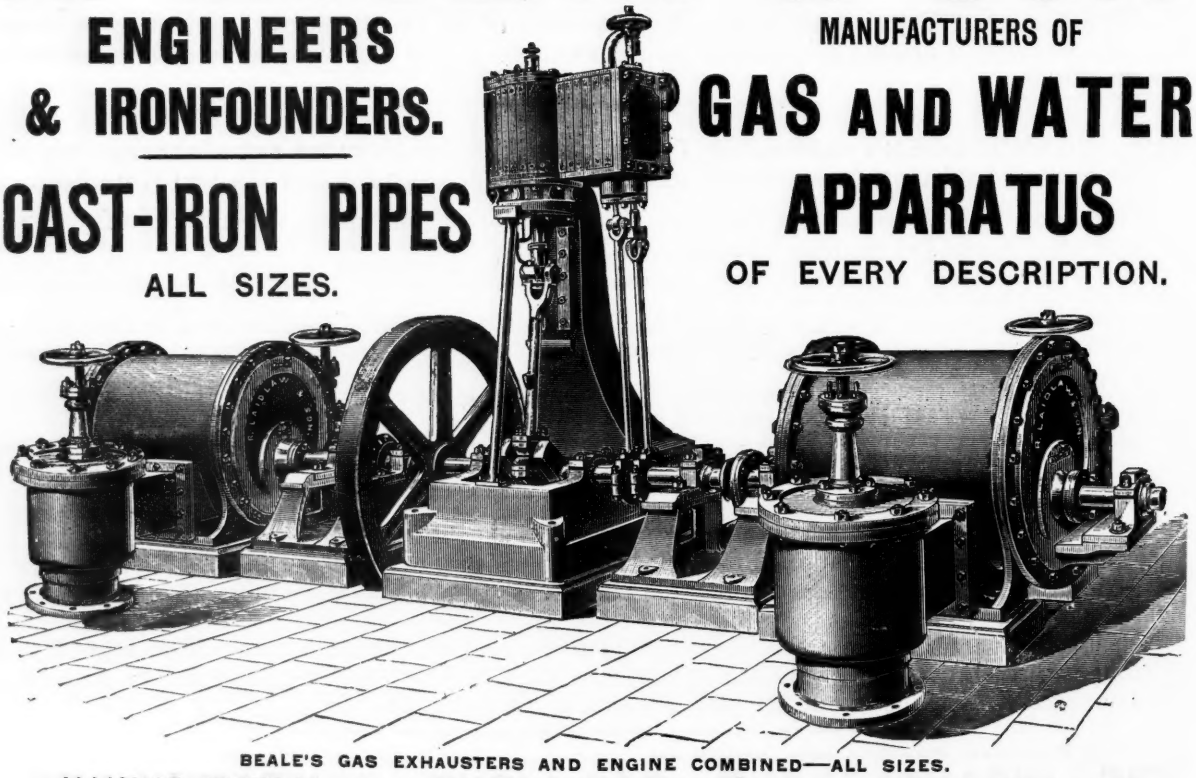

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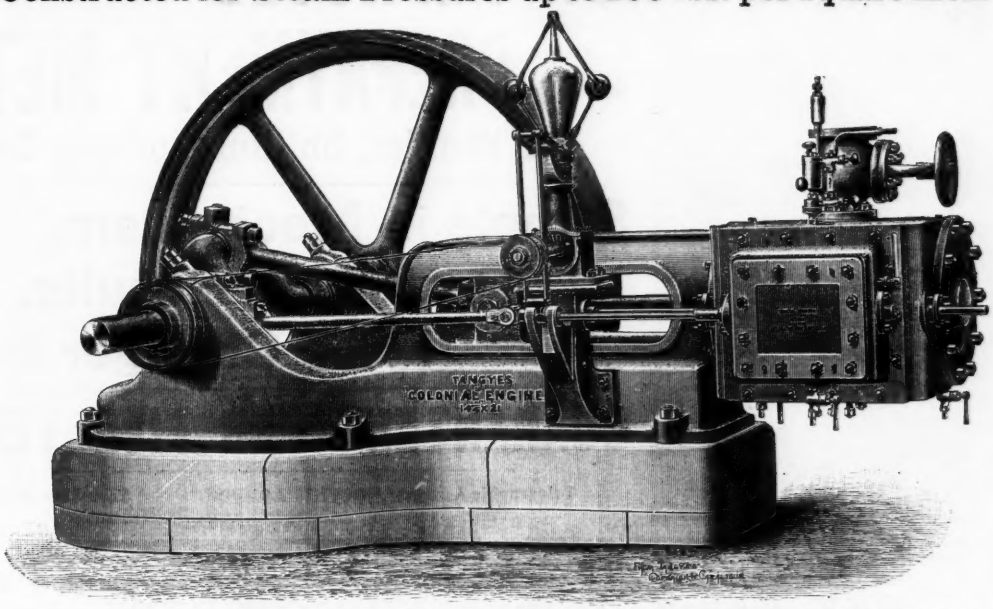
"COLONIAL" STEAM-ENGINE

Constructed for Steam Pressures up to 100 lbs. per square inch.



Tangyes' "Colonial" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 14½ in. by 21 in. size.

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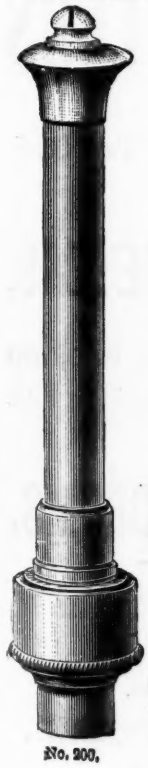

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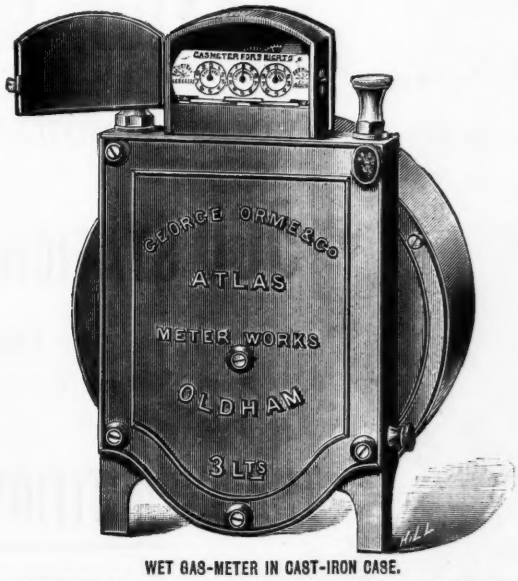
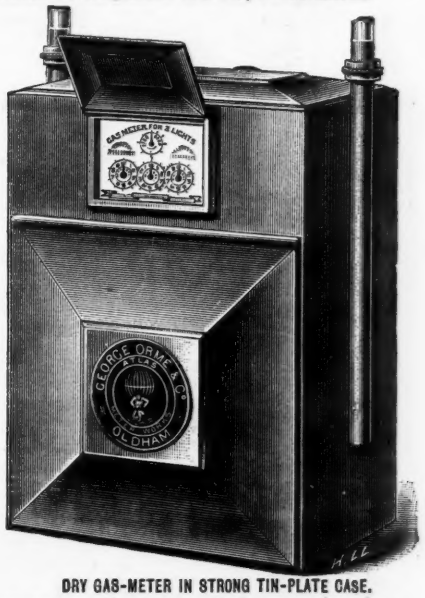


WET GAS-METER IN CAST-IRON CASE.



DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR FOR STREET LAMPS.

AS ILLUSTRATION NO. 200.

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Main Gas Cocks, Pressure-Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

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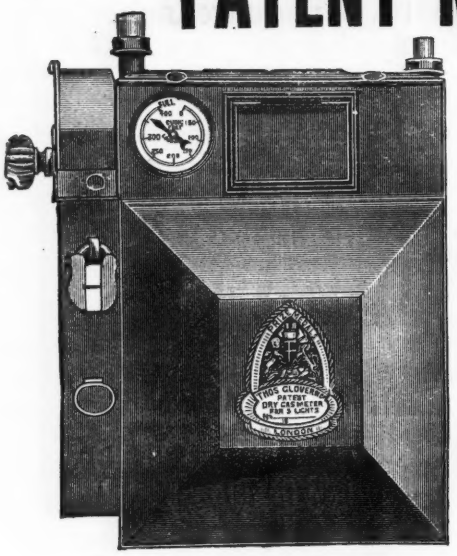

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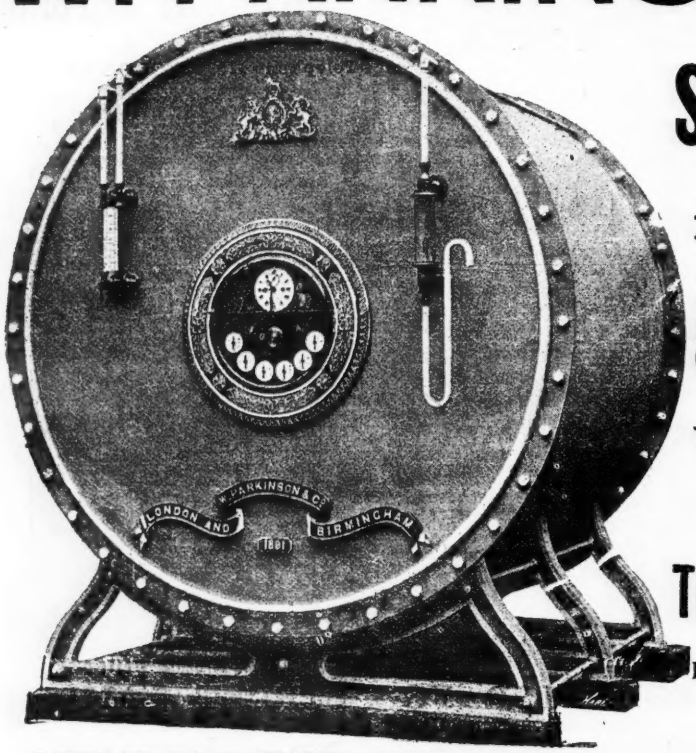

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

Coal Gas as a Locomotive Power.

IT has been already noticed in these columns that, just before the fall of the late Administration, Mr. Shaw Lefevre took steps to obtain an alteration of the law at present hampering the development of mechanical power vehicles for common roads. In connection with this movement, our contemporary the *Engineer* offered the munificent prize of 1000 guineas for self-propelled road carriages; believing, with reason, that the amendment of the existing law on this subject may very well result in the creation of an important new home industry. The change of Government threatened at one time to throw the legislative question into the background; and accordingly our contemporary prepared a memorial, for signature by engineers and others, praying that the cause might be taken up by the new President of the Local Government Board. Happily, however, by the more expeditious means of a question addressed to the Minister in the House of Commons, an assurance has meanwhile been obtained that the matter will not be lost sight of. It is therefore open to the ingenious to apply themselves, with all the ardour that the opportunity demands, to the production of such self-propelled vehicles as may appear likely to obtain first of all a share of the premium offered by the *Engineer*, and afterwards an even more remunerative meed of public patronage. In this connection, there should be hope for those who turn their attention to the capabilities of compressed gas as a motive power for use on common roads. The experience gained from the employment of gas power in working tramcars at Dessau and elsewhere should constitute a valuable datum from which to make the new departure. Herr von Oechelhaeuser's paper on the subject, published in last week's JOURNAL, is a timely contribution to the by no means plentiful literature of this interesting branch of technics. It proves that, at any rate, gas power is well to the front as a means of driving tramcars; and there is no apparent reason why it should not answer as well off as on the rails. The electricians appear to be flattering themselves that the solution of the problem is in their hands; but the evidence in support of this supposition is extremely slight. Even for working tramcars, electricians can do nothing without the objectionable trolley wire, which is, of course, impossible for free road traffic. Their only aid to free carriage driving is the accumulator, which has never yet succeeded in justifying itself for this application, notwithstanding the tens of thousands of pounds that have been spent in experiments with this ponderous and inefficient means of propulsion. The most successful self-propelled road carriages yet made have been driven by steam or petroleum-spirit engines, especially the latter; and it is with the best of these that the adaptors of gas motors to the new application will have to compete. We have had in this country the utmost liberty in regard to the construction of mechanically propelled small and light river launches, which from one point of view may be regarded as analogous to light road carriages; and plenty of experience has been gained from the use in these craft of electricity, steam, oil, or naphtha as the source of power. So far as we are aware, gas power has not hitherto been tried for vessels of this class, with the exception of a French gas-driven barge, which proves the rule. It is not likely, however, that launch experience will help much the designers of self-propelled road carriages; the differences of the conditions being so radical and irreconcilable.

Some French experiments with mechanically-driven road carriages appear to favour the use of the naphtha-engine, which is practically a gas-engine. It remains to be seen whether naphtha or compressed gas is preferable on all counts as a portable source of energy. For compactness, there is probably nothing to surpass petroleum spirit; and if Mr. Maxim's judgment in the matter of driving his flying-machine is worth anything in this connection, it may be better to burn the spirit as a fuel for raising steam than to gasify it for use in an internal-combustion engine. Naphtha and spirit, on the other hand, are dirty, and are not devoid of risk in handling or using. A cylinder of gas, on the contrary, is incapable of making a mess; and the risk of carrying and handling it is certainly less than that attaching to volatile mineral spirit. It must not be forgotten, moreover, that the noble animal, the horse, whose place

between the shafts is to be taken by the engine carried in the body of the conveyance, is not free from little tricks of his own. The subject of risk, indeed, hardly enters into the discussion of the suitability of compressed gas for driving vehicles. A certain, or rather uncertain, amount of danger attaches to the use of every appanage of material civilization; and unless this amount can be proved to be materially increased by any particular appliance—which is not the case with compressed gas motor engines—there is no need to regard it as affecting the issue.

We were recently "hauled over the coals" by an electrical contemporary for drawing attention to the enormous waste of power that appears in the equipment of an electric tramway. We ventured to remark, with reference to a Brussels undertaking of the kind, that stationary steam-engines indicating 900-horse power seemed to be an extravagant allowance for working twenty-two cars; and we were told that we knew nothing about the matter. The conditions of using horse and electrical power were stated to be so different, that it is impossible to judge of the requirements of the latter by the capabilities of the former. It was admitted, however, that it is the starting that uses up the motive power of the electrical machinery so wastefully. This is reasonable enough, for everybody knows that starting an engine of any kind with the load on is a different thing from running away with it afterwards. How much nominal power would need to be provided for an electrically-driven vehicle capable of carrying four or six people, for use on common roads, to ensure its starting in all circumstances, we do not know. But Herr von Oechelhaeuser reports that the Dessau tramcars do their travelling with a gas consumption of only 31·2 cubic feet per mile run, including the loss in compression, which is remarkably little. Not much more than one-half of this quantity ought to be needed to do an amount of work on common roads equivalent to that of one carriage-horse trotting at a fair rate of speed for this gait—a rate that should never be exceeded by anything on wheels, off a special track.

The subject, however, might be discussed at greater length than we can find room for here, without being exhausted. We can only express the hope that mechanicians will rise equal to the occasion, and that the best system, whatever it may happen to be, will win. It is not to be supposed that the gas industry will reap much profit from the supply of compressed gas to users of mechanically-driven road vehicles, even if the gas-engine were to surpass all its rivals for this application. But the great thing to be desired is that coal gas, like every other product of Nature and Art, shall be made, by the ingenuity and industry of man, to yield up, for the benefit of the community, whatsoever capabilities of subserving the common good may be inherent in it.

The Manchester Institution Meeting.

THE Manchester District Institution of Gas Engineers met at Buxton on Saturday last, under the presidency of Mr. George Smedley; and the meeting was pleasant and successful in every way, as indeed could hardly have failed to be the case under such genial auspices and in such favouring circumstances. The paper read was by Mr. R. G. Shadbolt; and it described, in an acceptable manner, some instructive experiences in gas purification—more especially in connection with the attempt to approximate the ordinary to a continuous process in closed vessels by the help of air and steam. As usual, Mr. Shadbolt's instruction in this fascinating pursuit was led up to by the common difficulty of gas purification—a growing "tightness" of accommodation. His paper narrates how he began to use air with a view to obtaining continuous revivification, and what were the immediate and deferred consequences thereof. It is significant of much that, whereas the immediate results of several of the author's experiments were satisfactory, no sooner did most of them appear to be settling down to produce a regular effect, than some little unforeseen trouble or other manifested itself. All this is very consoling to the average gas manager, who has generally found the way of technical improvement selected by himself sown by the same kind of thorns. It seems so obvious, upon a course of reasoning suggested by some successful laboratory experiment or other source of information, to make this or that amelioration of the processes of gas manufacture—the data are all in order, the conclusion is so evident! And so it is tried, with the frequent consequence of the whole scheme tripping up over an unsuspected obstacle—trifling, perhaps, but sufficient to stop progress along that line for an indefinite period. Happily, these are junctures where mutual help is apt to be better than self help. A solitary worker who has been brought up "all standing" against a wall of difficulty, learns in friendly converse with a kindred spirit that the latter has "been there," and perhaps has seen the way out—which he promptly discloses to his brother technician. So in the present instance, when Mr. Shadbolt had progressed so far with his purification researches that "the matter was "allowed to stand over for some time," he heard Mr. Dexter's Gas Institute paper on the same subject. It gave him the "lift" he needed, and sent him on his way rejoicing. When a writer of a technical paper hears of such a result as this, it repays him tenfold for all his pains in observing and recording his facts and formulating his suggestions.

Features of the Latest Gas Legislation.

THE Gas Acts of the present year, though not numerous, present several points of interest, as will be seen from our summary of their principal provisions which appears in another column. Parliament has not shown any pedantic fear of extending to the cases of Scarborough and Newmarket the consolidation of stock upon a basis more nearly approximating to the investment value of the property which has already proved advantageous to other provincial gas undertakings; so that it may be hoped that when next the question of unification is broached in connection with a Metropolitan Gas Company, the road to a satisfactory solution will be made easier by that potent lubricant "precedent." The treatment of the sliding-scale by Parliament, as exhibited in the instances of Newmarket, North Middlesex, and Hayward's Heath, shows signs of a progressive movement, and deserves attention. At last the anomalous position of new 7 per cent. stock, which in older Acts enjoyed the same rate of increase or decrease of dividend under the sliding-scale as original 10 per cent. stock, has been corrected. The expedient of the "neutral zone" has not, however, been repeated this year. Measures have been taken to remove the uncertainty that has hitherto existed with regard to the period of time over which increases or decreases of the price of gas must extend in order to legalize a corresponding alteration of the rate of dividend. The solution now given to this problem appears reasonable; and, in all probability, sliding-scale companies generally will conform in this regard to the spirit of the latest Acts. It is to be noted, not with satisfaction, that gas legislation is still accidental, and destitute of controlling principle, in respect of many points of contact between the suppliers and consumers of gas. The attention of parliamentary authorities might profitably be directed to the discordances that exist in many Acts, and are repeated every session, between the conditions imposed in such matters as the giving of notices of discontinuance, the rate of interest payable on consumers' deposits, the requirement to pay in advance for gas, and other matters of considerable practical importance. It is difficult to understand why what is law in one district in any of these respects should not be law elsewhere, if it is good and expedient; or why certain gas undertakings or their consumers should be favoured or hampered with special regulations which other districts are able to do without. This may or may not be an opportune time for the drafting of a new Gas-Works Clauses Bill. But the Committee on Police and Sanitary Regulations might, if necessary, have their powers extended to inquire into the need for these special enactments when introduced into Private Bills.

The Examinations in Gas Manufacture.

THE programme of the Technological Examinations of the City and Guilds of London Institute has been published, and may now be obtained by those who are interested in the cause represented by the Gresham College organization. Readers of the JOURNAL will naturally be most attracted by the examinations in Gas Manufacture (now under the control of Mr. Alfred Colson), which are fixed for May 5 next. We are able to compliment the Examiner upon his syllabus, and also upon his helpful catalogue of works of reference suitable for the use of students. The "papers" set by Mr. Colson for the last examination (given in the JOURNAL for July 2) were pointed and imbued with the

modern spirit in a highly satisfactory degree, although, if anything is to be said by way of criticism, it is that the character of the two sets of questions, for the Ordinary and Honours grade respectively, tends to become more uniform than seems to be altogether desirable. This is a point that we are not disposed to insist upon very strongly, because the Examinations Board may be credited with being in touch with the candidates, and with the desire to suit the questions to the class of students who present themselves for examination. Mr. Colson must beware of repeating himself. Last May he asked (Question 6, Ordinary Grade) what is the use of an exhauster; and next year, according to Paragraph 12 of the syllabus, he may require the similar information. It is difficult to vary technical questions without departing from the general level of difficulty; and we shall know better, when the report on the results of the last examination appears, how the last papers struck the candidates. A rule that seems a good one for the preparation of "papers" of this kind is that the Ordinary Grade questions should refer mainly to simple manual operations, such as constitute the very A B C of gas manufacture; while the advanced questions might probe deeper into the stores of information which students aiming at the professional *status* might be expected to have at command. And there might be one or two real "twisters" thrown in, to test the judgment and critical faculty of the aspirant, as well as his merely assimilative powers. We offer these observations, not with the desire to make the work of the Examiner more difficult, but rather to help in establishing something like a standard to which both Examiner and candidates could refer. There can be no doubt that these examinations are doing real good in systematizing the study of gas manufacture, and emancipating learners from the unintelligent following of routine.

The Trade Union Congress.

The twenty-eighth Trade Union Congress meets at Cardiff this week; and the public are curious to see the issue of the gathering, in the exceptional circumstances. The Congress used to be a very humdrum affair—at least for outside spectators—before 1890, when for the first time the fresh element known as the New Unionism manifested itself in force. Thereafter the proceedings became infinitely more lively. The new element was composed of a pack of hungry Socialists rejoicing in having found in the new unions of unskilled workers that means of support, both material and moral, which they had previously lacked; and with these mercenaries were mingled a few honest enthusiasts who thought the millennium was nigh at hand. The new unions were springing up all over the land; and their "leaders" were to be counted in scores. The representatives of the older unions at the 1890 and following Congresses were swamped by the new hordes, marshalled as these were by professional chiefs who knew no more about the real needs of organized labour than they did of the principles of political economy or the rules of fair play and right dealing as between man and man. But what these parties did know was how to make themselves notorious. Like certain demagogues of olden times, they "sucked no small advantage" out of the individual and collective eminence which the upheaval of the New Unionism (with themselves on the top) conferred upon them. And they made the Trade Union Congress more Socialistic, or Collectivist, every year. The practical cause of the worker disappeared into the background, while these mountebanks passed resolution after resolution for the construction of a new industrial world upon the most fashionable Collectivist principles. The interval of dementia culminated at the Congress last year, when a large majority of delegates, mostly sent by the newest of the new Unions, and being men individually of no importance whatever, carried a resolution pledging the Congress to favour "the nationalization of the land, mines, minerals, "royalty rents, and the whole of the means of production, "distribution, and exchange." Mr. Keir Hardie was at the bottom of all this; and mightily he and his associates plumed themselves upon their triumph. But it was as short-lived as it was utterly barren. A good many things have happened since this Norwich Congress. Among others, the saner heads of Trade Unionism saw that it would never do to allow the movement to be dragged at the heels of visionary Socialists; and so they bestirred themselves to amend the rules governing membership of the Congress, with the result that the whole order of professional agitators having no real connection with the trades they pretend to represent, will be shut out from the organization. The broom has been applied unsparingly; but it is not to be supposed that the clearance will pass unquestioned. As soon as the Congress meets, the battle between the Old and the New Unionism will be set; and, if fought out to the last extremity, one or the other side will be driven from the organization. The issue is not doubtful; for while Trade Unionism has done, and can do, without Socialism, Socialism or Collectivism can do nothing without Trade Unionism, upon which it is merely a parasitic growth.

WATER AND SANITARY AFFAIRS.

The five East-end Vestries and District Boards who, in the course of last week, sent a deputation on the subject of the water supply, first to the County Council, and subsequently to the President of the Local Government Board, were doubly armed in the latter instance, their verbal arguments being fortified by a requisition duly signed by twenty inhabitant householders of the East London district, asking that the grounds of complaint respecting the water supply should be inquired into in accordance with the provisions of the Metropolis Water Act, 1852. This requisition is said to have been presented to Mr. Chaplin after the deputation had come to the end of their interview. According to another account, the requisition was forwarded to Mr. Chaplin in the letter from the Vestry Clerk of Hackney, which sought that the deputation might be received. In either case, the requisition is lodged; and we may suppose that it will be acted upon, though it seems to introduce an incongruity. There is an air of compulsion on the one hand; and, on the other, the inquiry is simply asked for. The deputation found Mr. Chaplin thoroughly impressed with the importance of the subject they brought before him; and quite ready to hear what they had to say as to the alleged negligences and offences of the East London Company. Mr. Kyffin, who was the chief speaker of the deputation, did not believe in the drought, nor in any failure in the quantity of water available for distribution. What he believed in was the perversity and stupidity of the Company in creating an artificial famine. Mr. Chaplin, in reply, would not undertake to believe anything off-hand, either for or against the Company, though he was sufficiently fair to the latter to cite the terms of their defence. He saw no insuperable objections to the inquiry which the deputation wanted; but he apprehended certain difficulties, and desired to become better acquainted with the powers possessed by his department in carrying out such an investigation. While holding his final decision in suspense, he undertook to lose no time in coming to a conclusion, and said he would communicate his decision at the earliest moment. Mr. Sydney Buxton, "as a Liberal member," thanked Mr. Chaplin "most cordially" for what he had said, and accepted the "half promise" as something more than he (Mr. Buxton) had ventured to expect. It was evident, from some of the remarks offered by Mr. Chaplin, that any inquiry which he might make as to the supply of water, would be mainly directed to the discovery of such methods as would prevent a recurrence of the recent misfortune. Precautionary measures for the future would thus be aimed at, rather than the apportionment of blame for the incidents that are past.

Apart from a result to which we shall immediately refer, the visit of the deputation to the County Council, which took place three days before the interview with Mr. Chaplin, was chiefly remarkable at the time for giving Mr. Kyffin an opportunity of getting his acrimonious attack on the East London Company into print. In the name of a million and a quarter of people, Mr. Kyffin asked that the Council should take proceedings against the Company for the purpose of enforcing penalties. But Dr. Collins, the Chairman of the Committee before whom the deputation appeared, expressed considerable doubt as to whether the Council had so much law on their side as would enable them to take action of the kind proposed, with a reasonable prospect of success. Counsel's opinion was rather discouraging on this point; but the Committee would give the matter further consideration, and would do all that lay in their power "to secure an efficient supply of water for the East-"end of London." Dr. Collins might have added that

during 1893 and 1894 the Council had done all they could in the opposite way. The further result to which we have alluded as connected with the deputation, consists in the use made of a statement emanating from that source, that while the East London Company averred there was a drought, they continued a full supply of water to those of their customers who were served by meter, to the detriment of the ordinary customers who paid by rate. The Committee are now collecting evidence on this point with the aid of the Hackney Vestry, in the expectation that the Council will take proceedings against the Company under the Metropolis Water Act, 1871. Had the factories and other establishments been deprived of water, how would the wages class have been affected? And what benefit would it have been to the ordinary consumer if the factories had not been supplied?

It may not unreasonably be made a matter of surprise that, though the East London Company have a larger capacity in their reservoirs for unfiltered water than any other Company, their district should be the only one in the Metropolis which has suffered any scarcity of water in consequence of the drought. In this apparent anomaly we probably find a clue by which the entire question may be solved. The Companies drawing their supplies from the Thames have not suffered any privation, for the simple reason that, while their subsiding reservoirs are less capacious than those of the East London Company, they have in the Thames what is virtually an inexhaustible reservoir. The East London Company have no such resource to fall back upon. They may, indeed, draw ten million gallons a day from the Thames; but that is scarcely one-fourth their entire daily supply. They may also draw from the Lea. But that is a river of much smaller dimensions than the Thames; and its stream is subject to certain demands from the New River Company and the Conservators. Hence the East London Company are under the necessity of constructing large impounding reservoirs, to make the storage in a great measure quite independent of the Lea. With a rapidly-increasing population, the reservoirs must necessarily be increased in size or number from time to time; otherwise the supply cannot keep pace with the demand.

The Managership of the King's Lynn Gas-Works.—Mr. E. G. Smithard, of Chelmsford, has been appointed Manager of the King's Lynn Gas-Works, for which position applications were invited in the JOURNAL for May 28 last, under No. 2533.

The Gas Supply of Montreal.—A correspondent, writing from Ottawa on the 20th ult., says: "The Montreal Gas Company have now officially obtained the contract for supplying gas to the city of Montreal at $1·20 per 1000 cubic feet, and $1 for heating, for the next ten years, with the option of another five years by paying 3 per cent. of the gross profits. This ends the vexed question for the next fifteen years. Mr. E. Herbert Stevenson and Mr. H. S. King arrived, two days after the acceptance by the Council, with a new opposition scheme, and were much disappointed at being too late. They have both returned to London."

Eastern Counties Gas Managers' Association.—We learn from Mr. H. Wimhurst, of Sleaford, the Hon. Secretary and Treasurer of this Association, that the fourteenth general meeting will be held in the Town Hall, Wisbech (by permission of the Mayor, Mr. A. W. May), on the 12th inst. Luncheon will be provided at the gas-works, by the Directors of the Gas Company; and the business will commence at two o'clock, under the presidency of Mr. C. W. Grimwood. Two new members will be proposed for election; and three subjects will be brought forward for discussion—viz., "The Incandescent System as Applied to Public Lighting," "The Regenerative System of Firing," and "The Manufacture of Sulphate of Ammonia on Small Works." The officers for next year will be elected; and the date and place of meeting fixed. At the close of the business, the members will dine together.

The Federated Institution of Mining Engineers.—The annual general meeting of this Institution is to be held to-morrow week at Shelton, near Stoke-upon-Trent, under the presidency of Mr. W. N. Atkinson. Among the papers to be submitted is one on "The Depth to Productive Coal Measures between the Warwickshire and Lancashire Coal-Fields," by Mr. C. E. De Rance, F.G.S. Papers presented at previous meetings will be open for discussion; among them being the following: "Mining Explosives," by Professor Vivian B. Lewes, F.I.C., F.C.S.; "The Change of Composition Produced in Air by Flames and by Respiration" and "The Limiting Explosive Mixtures of Various Combustible Gases with Air," by Professor Frank Clowes. These papers have been already noticed in the JOURNAL. At the close of the business, the members will drive through Trentham Park, the seat of his Grace the Duke of Sutherland; and on their return will dine together. The following day will be devoted to excursions.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 501.)

THERE was quite a revival of activity in the Stock Exchange last week, after the quiet period which had preceded it. Although it was account week, the business of the settlement by no means monopolized attention; but fresh business proceeded briskly. Taken all round, the markets were active and strong, with but few exceptions, and prices were buoyant. The most notable incident of the week was the sensational jump of British South African shares, which was made in response to large buying orders after some little vacillation. The settlement was easily got through; and this helped to impart a roseate hue to the general complexion of affairs. As a matter of course, money was more than abundant; and, within reasonable bounds, there need never be any difficulty in meeting the fortnightly requirements. The Gas Market meanwhile has pursued its own normal course, unaffected by feverish speculation. Business was on a fairly moderate scale as far as volume was concerned; and the general firmness was fully maintained, heightened by one or two considerable strides upwards and some other more moderate advances; while in only one instance was there a retrogression in value. Gaslight "A" was firm and steady, with a little tendency to improve towards the close, when stock changed hands more than once at 295. Very few transactions were marked in the secured issues; but they showed great strength—the 6 per cent. debenture stock in particular fetching 205. South Metropolitans were moderately active, and prices were good; while the quotations sprang up freely upon *ex div.* correction. In Commercials, business was confined to the debenture stock, the quotation of which was left unchanged, though the stock realized a better price. Not a single transaction was marked in Suburbans or Provincials; but several quotations rose considerably. Business in the Continental division was next to nothing. Unions had a smart rise; but Imperial fell back a point. The rest were not noticeable. All the Water Companies were quiet, and decidedly flat; several quotations being written down freely.

The daily quotations were: The Gas Market opened very quietly on Monday, and hardly anything was touched but Gaslight "A." Prices were firm. Continental Union improved 5; and South Metropolitan debenture, 1¼. In Water, Southwark fell 2½. On Tuesday, business in Gas was inconsiderable, and nothing moved. Water was flat again—Southwark receding 2 more; and East London, 4½. There was a much better show of activity in Gas on Wednesday; but again quotations were left standing unchanged. On Thursday, the course of things tended to relapse into inactivity; but prices in general were good, except for Imperial Continental, which fell 1. In Water, West Middlesex was 2 lower. Business was extremely quiet on Friday; but both Alliance and Dublin issues rose ½. Lambeth Water fell 1½. Transactions on Saturday were on about the same level; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

Electrical Supply at 230 Volts—The 8-Candle Power Incandescent Lamp—The Electrician's Trouble.

A SOMEWHAT remarkable article, with the title "Electrical Supply at 230 Volts," recently occupied the leading position in the columns of the *Engineer;* and one might, at the first sight of such an essay in such a place, naturally wonder at the circumstance. Like the celebrated analogy of the appearance of straws in amber, it is not so much the richness or beauty of the object that arouses interest in the phenomenon, but wonder as to how it got there. Are there not electrical periodicals enow, that our old engineering contemporary should give up its ample space to the discussion of questions of detail in regard to the distribution of electricity? What is the point, at any rate, that this particular article aims at elucidating? Some study of the composition in question is necessary to the obtaining of an answer to this query, inasmuch as it is written in the "journalese" dialect favoured by certain popular newspapers. It begins by talking about driving a coach-and-four through an Act of Parliament, and concludes with a dissertation on the advantages of 8-candle power incandescent electric lamps. Upon examination, the whole thing appears to have been suggested by some experience in electric supply gathered at Bradford, where the pressure in the mains is maintained at 115 volts; and the conclusion sought to be enforced is that to change from 115 volts to 230 volts would be a "grand step." It seems to be the writer's idea that this is to be the fashionable electric pressure of the future, because it will enable existing mains to do so much more duty, without apparently sacrificing the principle of low pressure with its supposed concomitant safety. Only this prospect brings up the question of the lamp—especially the 8-candle lamp; and hereby hangs an interesting development of the commercial aspect of electric supply.

Fairly serviceable incandescent lamps can, it is stated, be had for a 230-volt supply, but not of so low a power as 8 candles

This consideration starts our contemporary upon certain most instructive reflections as to the uses of lamps in private dwellings. We are told that economies that were never dreamt of when paraffin lamps or gas were used are regularly and readily practised by consumers of electric light; and that "not the least of these economies is the use of 8-candle power lamps, especially for passages, staircases, bed-rooms, and lamps for occasional use." It may be easily believed that users of electric lamps need to practise all the economies they can think of, if their bills for light are to be kept down to within three or four times the cost of equivalent gas or petroleum lighting. It is possible that the 8-candle lamp may be useful in this regard. But, if we remember rightly, this pattern of lamp was introduced deliberately by certain electric supply engineers in charge of West-end central stations with a view to delude consumers into the belief that they were equivalent in lighting power to an average gas-burner or oil-lamp. They were not demanded by the consumers in the first instance, but formed part of an artfully concocted scheme for reducing the scale of interior house illumination. It was argued that if the consumer had a bright light here and there in his house, while the rest were of low illuminating power, he would have the impression that these others were dull. It would never do to fit up an ordinary dwelling-house with (nominally) 16-candle power incandescent lamps throughout, because then the first quarter's bill would cause the loss of the connection. So the less terrible 8-candle lamp was recommended; and most, if not all, of the London electric lighting companies reckon their numbers of lamps connected by this standard. For shops and business purposes, however, the 8-candle lamp has never been a success, either in London or anywhere else.

The conclusion of the whole matter is that the cost of electric lighting to the consumer is still, and will probably continue to be, the greatest bugbear for electric supply engineers. This is really the burden of the *Engineer* article, which thus only ventilates with reference to a particular case those considerations which are more often present to the minds of followers of the electric lighting interest than any of those mathematical or physical problems that usually fill the columns of the electrical journals. It does little good to the cause to continually harp upon this trouble; and therefore the prudent electrician habitually acts upon Gambetta's counsel in regard to the question of the lost provinces of France—speaking of the subject never, but thinking of it always. He knows full well that electric supply, as distributed from a central station, is an expensive luxury, and accordingly he does everything that lies in his power to help the user to economize in its use. He would rather supply current to an 8-candle lamp than to a 16-candle lamp in an ordinary dwelling-house, as the writer of the *Engineer* article frankly confesses. His remark is that, "Many a manager of a London supply company would sooner connect one hundred 8-candle lamps spread over three houses than the same number of 16-candle lamps in one house." No doubt. "The big house will be shut up for half the year, and the bulk of the lights will only be used when guests are being entertained. The small houses, on the other hand, will use a steady number of lamps nearly all the year round, and will not haggle for rebates. These are the consumers to encourage; and the economical lighting of small houses is made possible by the use of 8-candle power lamps." It is further confessed that to "afflict" such customers with 16-candle power lamps throughout "would be either to raise the cost very considerably, or to push their already economical habits to very irksomeness." Just so. It is only by persuading the householder to put up with a very much lower standard of lighting than he could indulge in by the aid of ordinary gas or oil lamps, and, besides this, to practise a degree of economy with respect to the lighting and extinguishing of his lamps which renders his life almost a burden to him, that he can be persuaded to "do with" electric lighting at all. Even then, his attitude with regard to the advantages of the system at current prices is in such an unstable state of equilibrium, that the sight of an incandescent gas-burner in the hall of the next-door house is frequently enough to upset him. For it must be remembered that what the electrician calls an 8-candle lamp is usually so only in the sense of a useful convention. It may have been able to give a light equal to that of 8 candles when at its best; but its best never lasts long. The 8-candle lamp is a concession to the exigencies of the electric supply business, rather than a true friend of the consumer. It is a frail creature if put up to do its duty fairly; and, if made durable, it is far more voracious of current than liberal in its returns.

The Chairman of the Wakefield Gas Company.—The shareholders of the Wakefield Gas Company have passed a resolution, requesting the Chairman (Mr. W. Statter) to allow his portrait to be painted for the Board-room, and setting aside £200 for the purpose. Mr. Statter has presided over the Company for upwards of fifty years.

The Action of Water on Coal.—Experiments made by M. Georges Arth on the action of water on coal have shown that powdered coal of various kinds, containing from 1·6 to 8·3 per cent. of oxygen, when subjected to the prolonged action of air and of stagnant and running water, is not appreciably affected with regard to composition, yield of coke, or calorific power.

GAS ACTS FOR 1895.

The following are the particulars of the Private Acts relating to gas supply in the United Kingdom which became law during the last parliamentary session. One Bill—that of the Rotherham Corporation—which contained gas clauses, was held over on account of the dissolution, and has not yet been disposed of by the new Parliament.

The Hayward's Heath Gas Act incorporates a limited Company formed in 1865, having at the date of incorporation a share capital of £6500, of which £6000 was fully paid up, and the Company had borrowed on debentures £2400 and £400 on a promissory note. The limits of supply are defined, and a portion of the parish of Cuckfield is included, subject to the proviso that, unless and until the Company shall have purchased and acquired the undertaking of the Cuckfield Gas Company, Limited, they shall not, without the consent in writing of the Urban District Council of Cuckfield and the Cuckfield Gas Company, supply gas or exercise any of the powers of the Act within the said urban district, except that portion wherein their mains are already laid. Provided, also, that if the Urban District Council aforesaid shall at any time before the transfer in question themselves undertake to supply gas throughout all or any part of their district, the Company shall not be deemed to be a company authorized by statute to supply gas within the district, within the meaning of the Public Health Act, 1875. The capital of the Company is £30,000, instead of £50,000 as asked for in the Bill; whereof £6000 is called the original capital, and the balance is to be new 7 per cent. ordinary or 6 per cent. preference capital. Borrowing powers are granted to the extent of one-fourth of the paid-up capital, not to be converted into share capital. The standard price to be charged for 15-candle gas is 5s. per 1000 cubic feet, with power to allow discounts not exceeding 10 per cent. The sliding-scale is corrected so as to equalize the benefits derivable by the holders of original and new capital, by allowing a range of 5s. and 3s. 6d. per cent. for a penny in the two classes respectively. The period of error for defective meters is limited to the current quarter, unless the contrary is proved to the satisfaction of the inspector. The Company may make contracts with public authorities and others for the supply of gas in bulk, for periods not exceeding seven years. The clause of the Bill proposing to relieve Directors of disqualification by reason of their holding other office under the Company or becoming interested in a contract with the Company, is modified into an enactment that no person shall be so disqualified by reason of his or any partner of his being or becoming interested in a contract with the Company, either in his own behalf or as a member of any other company, corporation, local authority, or partnership; but no such person shall, as a Director, vote in respect of any question as to such contract. The Company are to pay 5 per cent. interest on deposits; but are not authorized to demand payment in advance. They may erect workmen's cottages on their own land. Certain lands are to be compulsorily acquired within three years. The Newmarket Gas Company's Act incorporates the Victoria Newmarket Gaslight and Coke Company, constituted by deed of settlement in 1840, and registered as a limited company in 1865. The present capital consists of £30,000 of ordinary stock fully paid up; and there is no mortgage debt. Dividends at the rate of 10 per cent. per annum and upwards have for many years been paid upon the ordinary capital. The limits of the statutory Company are such part of the counties of Cambridge and Suffolk as lies within a radius of 5 miles from the Newmarket Town Hall. The new Company is renamed the Newmarket Gas Company, with capital arrangements as follows: From and after Sept. 18, £30,000 of ordinary stock of the limited company is to be converted into £60,000 ordinary stock fully paid up, with a dividend at the standard rate of 5 per cent. per annum. The capital of the Company is to consist of £75,000; whereof £15,000 is to be additional 5 per cent. capital, capable of being converted into stock when fully paid up. The Bill proposed an additional £20,000 of 7 per cent. capital. Borrowing powers to the extent of £15,000 are granted in respect of the original capital only. The Auditors need not be shareholders. An interim dividend may be declared without calling a meeting of shareholders. Contracts for the supply of gas for public purposes are not to be for more than ten years. The initial price of the Company's 15-candle gas is 4s. 8d. per 1000 cubic feet, with the sliding-scale at 2s. 6d. for a penny. This was the figure proposed by the Bill. Interest on consumers' deposits at the rate of 4 per cent. is to be allowed. Consumers desiring to discontinue, are to give 24 hours' written notice; and on neglect are to be liable to pay for all gas registered by the meter "up to and until the expiry of 24 hours from and after the discovery of the Company of the omission to give such notice." The Company are empowered to apply for an Electric Lighting Order or Licence, employing their ordinary capital in respect thereof. The North Middlesex Gas Company's Act incorporates a limited Company formed in 1862, which obtained Provisional Orders in 1871 and 1876, having a present capital of £45,000 fully paid, and £11,250 borrowed on debentures. The limits of supply are defined; the whole being situate in the parishes of Finchley and Hendon,

Middlesex. The capital of the Company is £80,000; whereof £45,000 is the old capital. Only £15,000 of this is 10 per cent. capital, all the remainder, including the new capital, bearing a 7 per cent. dividend. The usual proportion of borrowed capital is sanctioned, not to be converted into shares or stock. There is to be one Auditor of the Company; and he need not be a shareholder. Additional land is to be acquired, subject to the provision that works for the manufacture and storage of gas shall not be erected within 100 feet of the main road leading from Hendon to the Mill Hill Railway Station. The initial price of gas (15-candle power) is 4s. 3d. per 1000 cubic feet, with a corrected sliding-scale. The Bill proposed 4s. 9d. per 1000 cubic feet. The period of error in defective meters is limited. Workmen's cottages may be erected; and contracts for the supply of gas in bulk or for public purposes are limited to seven years. Interest on consumers' deposits is payable at the rate of 5 per cent. The Company are to make and keep up to date a map of their mains, on a scale not less than 25 inches to the mile, and allow the same to be inspected by the officers of the Finchley and Hendon Urban District Councils.

The above three Acts are the only statutes incorporating gas companies that came before Parliament for the year; and they are also the only Acts that embody the sliding-scale. In view of the importance attaching to this system of regulating gas prices and dividends, we desire to make a special reference to the terms in which the sliding-scale has been enacted in these three instances—particularly as they differ in some respects from earlier drafts. The Hayward's Heath and North Middlesex clauses are almost identically worded. They recite, in the first place, that "In respect of any year during *any part* of which the price charged by the Company shall have been one penny *or part of a penny* above the standard price, the dividend payable by the Company shall, in respect of each penny *or part of a penny* by which the standard price shall have been increased, be reduced below the standard rate of dividend by five shillings on every one hundred pounds of ordinary paid-up original capital, and so in proportion for any fraction of one hundred pounds, and by three shillings and sixpence on every one hundred pounds of ordinary paid-up additional capital, and so in proportion for any fraction of one hundred pounds." Then, for the reverse process it is enacted that "in respect of any year during *the whole of* which the price charged by the Company shall have been one penny or more below the standard price, the dividend payable by the Company may, in respect of each penny by which the standard price shall have been reduced, be increased" in the same proportion. In the Newmarket Act, the words printed here in italics are omitted. The object of the Legislature in the other instances obviously was to remove the uncertainty that has been felt by some Boards of Directors as to the period over which an increase or reduction of price must extend to authorize an alteration of dividend.

The British Gaslight Company, Limited (Staffordshire Potteries), Act empowers the Company to expend for the purposes of this particular undertaking a further capital sum of £75,000, whereof £45,000 only is to be capital stock of the Company, to bear a 5 per cent. dividend, and the remainder is to be borrowed money at 4 per cent. The first £15,000 to be spent must be borrowed, and all loans contracted under the Act must be raised on the best terms obtainable at the time of borrowing. Power is given to the Corporation of Hanley to appoint an Auditor, who is to be authorized to examine the accounts of the Company in relation to the undertaking annually at any time within two months after such accounts shall have been made up for the year then last past—all reasonable facilities thereto being afforded by the Company. It is provided, however, that the signature of the Auditor to the published accounts shall not be necessary; and he shall not be entitled to interfere in any way with the management of the undertaking. The remuneration of the Auditor is to be fixed by the Corporation; and the Company are to contribute an annual sum of not more than twenty-five guineas to this payment. A section of a former Act, which provides that any person appointed by a lighting authority under the section to test the illuminating power and purity of the gas supplied by the Company shall not be a member or officer or servant of the lighting authority is repealed. It was proposed in the Bill to spend £80,000 of capital on the undertaking, bearing 5 per cent. dividend. The Scarborough Gas Act empowers the Company to consolidate their different classes of ordinary stocks and shares into a uniform 5 per cent. stock, at any time after three years from the passing of the Act, and with the sanction of three-fourths of the votes of the holders present in person or by proxy at a general meeting specially convened for the purpose. New capital to the amount of £60,000 is to be issued, bearing a 5 per cent. dividend, to carry borrowing powers in the proportion of one-third of the fully-paid stock. The Bill asked for £79,000, with the usual borrowing powers. It is directed that the provisions as to auction and tenders for new stock issues shall apply also to debenture stock and mortgages. Additional lands are to be acquired compulsorily, for storing and purifying gas, under certain restrictions. The Company may supply gas in bulk; but not for consumption in the district of another statutory gas company without the consent of the latter. In addition to their existing testing-station, the Company are to provide a second testing-place at their office in Westborough. If tested at the former, the illuminating power of the gas is to be 16 candles; and if at the latter, 15½ candles. The gas supplied by the Company shall be deemed to be of less purity than it ought to be within the meaning of section 36 of the Gas-Works Clauses Act, 1871, if on three consecutive days it is found to contain, upon the average, more than 4 grains of ammonia or more than 25 grains of sulphur "in any one hundred cubic feet." No forfeiture is to be incurred if the default can be proved to be due to unavoidable cause or accident. In the event of the gas examiner finding any defect of illuminating power or purity in the gas, he is to forthwith give notice thereof to the Company at their office. The maximum price of gas is fixed at 3s. 6d. per 1000 cubic feet inside, and 4s. 6d. per 1000 cubic feet outside, the borough. The charge for the public lamp supply within the borough is to be 20 per cent. less than the price to private consumers, whenever the quantity furnished to such lamps is more than 10 million, but less than 15 million cubic feet, and 25 per cent. less when the supply exceeds the latter quantity. The Company may allow discounts not exceeding 10 per cent. to private consumers, in consideration of prompt payment or large consumption. At least one of the Auditors of the accounts of the Company must be a member of the Institute of Chartered Accountants or of the Incorporated Society of Accountants; and it is not necessary for an Auditor to be a shareholder. The period of error in defective meters is limited. Discontinuing consumers, in neglect of giving written notice, are liable to pay for gas registered by the meter up to the next ensuing indexing. Notice of this provision is to be endorsed on every demand note for gas-rental. Any notice required to be served by the Company is to be sufficiently authenticated by the name of the Secretary; or if it is a notice to pay a charge for rental, by the name of the Secretary or collector being affixed thereto in print or in writing (including lithograph), or by a stamp. The Company must not, under the powers of the Act, raise more than £6000 before Dec. 17 next; and if by this date the Corporation have deposited a Bill for the acquisition of the undertaking, the Company are not, without the reasonable approval of the Corporation, to raise any further sum of money until such Bill shall have been withdrawn or rejected by Parliament. If such a Bill becomes law, the price to be determined for the undertaking by arbitration as on a compulsory sale is to have regard to the following bases: In respect to stock or shares issued before the passing of this Act, the Corporation shall pay the full value determined as aforesaid. In respect of stock or shares issued after the passing of the Act, the Corporation shall pay the price at which they were issued, without allowance for compulsory sale. The Company are not to oppose the Corporation Bill except as to details. The second provision is to hold good for three years; but the Company are not to regard the Corporation as having any right to obtain compulsory purchase powers after the expiration of three years from the passing of the present Act.

The Carburetted Water-Gas Plant at Blackburn.—Pending a full report on the Merrifield-Westcott-Pearson water-gas plant at Blackburn, we are informed it was started on the 1st ult., or one month before the time called for in the agreement made with the Blackburn Corporation, and that it has been running satisfactorily since that date. It is said to demonstrate the assertions of the patentees as to the qualities of this type of plant, as it is running considerably under their guarantee with the Corporation, and, we learn, giving remarkable fuel results.

South-West of England District Association of Gas Managers.—The autumn gathering of this Association is to be held at Barry, near Cardiff, on Tuesday next. The meeting will be opened at the unusually late hour of three o'clock, so as to enable most of the members, if they wish, to leave home the same morning. But there is so much to see at Barry that all who can do so are advised to arrive there on Monday evening. In addition to the usual business, Mr. Lowe will propose an important step, having reference to the suggested amalgamation of the Southern and South-West Associations. Mr. S. W. Durkin, of Southampton, will submit a paper on a question that has acquired considerable importance of late years—viz., "The Want of Mutuality between the Various Authorities using the Subsoil of the Public Roads." After the meeting, there will be a visit to the docks, where extensive operations are now in progress. This will be followed by a dinner at the Barry Hotel; and here it is well to remind intending visitors that there is also a *Barry Dock* Hotel, and that the two are sometimes confused. An excursion for the Wednesday morning is also in contemplation. It will probably include a visit to the water-works pumping station (three miles out), and other places of interest. Barry is eight miles from Cardiff; and there is a frequent train service. At the spring meeting, it was decided that the autumn meeting should be held at Torquay. But the local member, Mr. Beynon (who was not present), represented to the Committee that important extensions are in hand, and he expressed a wish that the visit of the Association should stand over till they are complete. Under these circumstances, the Committee accepted the suggestion of Mr. F. M. Harris, the Manager of the Barry and Cadoxton Gas and Water Works, that the members should meet at Barry, especially as it was accompanied by cordial promises of support. Mr. Harris has been most energetic in arranging for the visit and excursions, and it is hoped that a good number of members will take part in this, the first, visit of the Association to South Wales.

NOTES.

The Spraying of Water and Air.

The attention of gas engineers and others requiring for industrial purposes a finely-divided water-spray may be directed to the seemingly paradoxical appliance described by Mr. Arthur Kitson to the Franklin Institute, under the name of the "ball nozzle." It is an appliance that has been introduced as a fire-hose fitting, and is of extremely simple construction; consisting merely of a bell-mouth nozzle and a ball. The nozzle is connected to a water or air supply, and the ball is placed loosely in its mouth; being kept from falling off by a cross-bar, which does not touch it. The peculiarity of the action of the appliance is that when a stream of air or water is turned on through the nozzle, the ball steadfastly adheres to it, and refuses to fall away, no matter in what position the nozzle is held. Variations of pressure between a few ounces and hundreds of pounds to the square inch fail to change the nature of the seeming paradox. In the case of water, the effect of the ball is to divide the jet into a thin, fan-shaped spray, spreading in a circle round the orificé. It is in this respect that the utility of the device appears, since there are many purposes for which an equable sprinkling of water is desirable. With a pressure of 80 lbs. to the square inch and a ball surmounting a $\frac{3}{16}$-inch hole, it is in this manner possible to distribute a water supply evenly over a circular area 60 feet in diameter. For ventilation also its use would be indicated. The action of the ball in remaining in close contiguity to the nozzle, notwithstanding the force of the water or air that appears to be driving it away, is referable to the atmospheric pressure upon the opposite side; the equal and similar pressure upon the side towards the nozzle being temporarily overcome by the momentum of the issuing water or air.

Saint's Water-Spraying Device.

Another water-spraying device which might perhaps be found useful for the washing of gas and other industrial purposes is the arrangement recently described by Mr. William Saint, one of Her Majesty's Inspectors of Mines, at a meeting of the Manchester Geological Society. This appliance is used for damping coal dust in mines, with a view to the prevention of explosions. It consists essentially of a sprayer, filter, and back-pressure valve combined in a metal fitting about 4 inches long, screwed for attachment to a ½-inch water-supply pipe. The body of the fitting contains sponge for removing any mechanical impurities that may be contained in the water, and might interfere with the proper action of the spraying attachment. This consists of a diaphragm fixed at a short distance below the orifice of the fitting, pierced with one or more diagonal holes, not central with the orifice itself; there being thus a small chamber between the plate and the orifice, into which water enters and whirls itself into a spiral discharge. The effect is described as the formation from the outlet of the fitting of a cyclonic and uniform mist-like spray. This mist issues with a noise and appearance similar to that of steam escaping from the safety-valve of a boiler; and it is so finely divided as to be readily carried along by even a slowly-moving current of air. The back-pressure valve is a simple affair, found necessary to prevent syphoning when several sprays are connected with the same supply. Mr. Saint referred to the performance of one of these sprays supplied with water under a pressure of 330 lbs. per square inch, when it discharged 5 gallons per hour; and the influence of the moisture was felt for 80 yards in a mine gallery. The inventor claims that this appliance will work at any pressure of water above 50 lbs. per square inch, and that by changing the plates the discharge can be varied from ½ gallon per hour upwards.

The Waterproofing of Bricks and Stone.

At a recent meeting of the Australasian Association for the Advancement of Science, Professor Liversedge read a communication relating his experience in the matter of waterproofing brickwork and sandstone with oils, which is summarized in the *Engineering and Mining Journal*. The experiments in question were directed mainly to ascertain the length of time that the waterproofing or protecting of brick and porous stonework with oil remains effective. The oils employed in the experiments were the three cheapest and commonest that could be most readily procured for the purpose, such as raw and boiled linseed and the crude mineral oil, known as "blue oil," used for protecting timber. The exposures were made upon the flat roof of a laboratory building, fairly open to the sun and weather. Good, sound machine-made bricks were chosen for testing. It was found that the sandstone (a local product) was much less absorptive of oil or water than the bricks. Raw and boiled oil appeared to be absorbed in equal proportions; but the mineral oil was taken up much more freely. By the end of twelve months, however, the whole of the blue oil had evaporated; the bricks returning to their original weight. The bricks treated with raw and boiled linseed oil remained unchanged. After a second oiling, in November, 1890, and exposure for a further period of nearly four years and two months, these bricks still retained all their oil, inasmuch as they had not lost weight, and were nearly impervious to water. The sandstone appeared to lose its oil—the specimen cubes returning to their original weight; but the good effects of the oiling were not lost, as the stone continued to be practically waterproof.

The Reason for the Non-Visibility of the Ultra-Red Rays.

It is sometimes asked why the human eye cannot perceive the rays below the extreme red end of the spectrum; and speculations are occasionally published as to the extent to which the visual perceptions of animals or insects may exceed ours in this respect. The explanation is that infra-red light is invisible to us either because the humours composing the eye are opaque to it, or else because the light is incapable of exciting the retina if it reaches it. All observers have found that, as a matter of fact, these rays are strongly absorbed in passing into the eye; and Helmholtz considered this absorption sufficient to account for their invisibility. Herr Aschkinass has demonstrated, in a paper published in *Wiedemann's Annalen*, that, though the eye does absorb a proportion of rays, there is no sudden increase of absorption for those lying beyond the red end of the spectrum, and that the absorptive powers of the various media of the eye are practically the same as that of water. The apparatus used in this investigation contained a fluor-spar prism and a bolometer. Thin layers of the humours of the human eye and that of the ox were placed in the path of the rays from a zircon burner; and the absorptive effects were measured by means of the bolometer. It was found that, throughout the limit of the visible spectrum, the absorption was at the rate of 5 per cent. for the whole human eye. This speedily increased beyond the limits of visibility, with a curious break in the gradual rise of the process at one particular point, until it attained 100 per cent. of the total absorption at 1·4 μ. This determination shows that, before total absorption occurs, a large proportion of infra-red light does actually reach the retina through the substance of the eyes, but is not capable of exciting the nerves, and so producing visual sensation.

The Use of Coal Gas in Gun Manufacture.

A remarkable application of coal gas is mentioned by Mr. Hiram S. Maxim in a description of a method of gun manufacture supplied by this prolific inventor to the *Engineer*. It occurs in connection with a proposal made by Mr. Maxim for turning out solid steel guns, as an improvement upon the usual built-up ordnance. He states that at Erith he has lately made a number of 45-pounder guns from the solid—has, in short, succeeded in doing with steel what was formerly accomplished with cast iron. In this process, steel capable of receiving a spring temper is first rough bored, and afterwards turned approximately to shape. The forging is then annealed. It is next turned nearly to the right size outside, smooth bored, and rifled. It is again mounted in the furnace in a vertical position; and while rotating in the furnace, a stream of coal gas is passed up through the bore. The coal gas of course expels the air, and at the same time a portion of its carbon is set free by the high temperature, and combines with the steel of the inside of the gun; thus raising the quality of the metal, and hardening it. While the gun is red hot, the gas is shut off, and a stream of cold oil under high pressure is forced through the bore while the gun still revolves in the furnace. The result is that the inside is very quickly cooled without decomposing more than half a pint of the oil; and the distribution of the stresses in the metal is exactly the same as if the gun were built up in coils, with the inside in compression and the outside in tension. One of the guns made in this way actually became smaller in the bore after firing a heavy charge. Mr. Maxim declares them to be the best guns that have ever been made, besides taking only half the weight of steel, half the time, and half the cost of making.

Dock Pumping with Gas-Engines.—Great interest is being shown in the new system of pumping by gas-engines carried out at the graving-dock of the River Wear Commissioners, at Sunderland, to which reference has been already made in the JOURNAL. At No. 1 dock, the installation consists of two 40 nominal horse power Tangyes' gas-engines, each connected direct to a 21-inch centrifugal pump, also of Tangyes' manufacture; one 8 nominal horse power gas-engine, working in conjunction therewith an 8-inch Tangyes' centrifugal leakage pump, and through a friction clutch an air-exhausting pump for charging the two main pumps with water at starting. The 40-horse power gas-engines have the beds cast with large flanged facings, so that the centrifugal pumps can be bolted to them; thus removing any fear of the engines and pumps getting out of line with each other. The pumps are each capable of discharging upwards of 2600 tons of water per hour, and of emptying the dock in less than two hours at the highest spring tides. When the pumps are doing their maximum duty, the gas-engines will each be capable of indicating more than 120-horse power. To ensure that the engines will start without fail, and unaided by manual labour, they are fitted with Tangyes' latest pressure-starter (Pinkney's patents). The 3-horse power engine has a small pump attached to its bed; and it can be thrown into and out of action at the will of the attendant. It is employed to pump a charge of gas and air into a mild steel receiver to a moderate pressure. This receiver is connected to the two 40-horse power gas-engines by means of piping and starting-valves, so arranged that the pressure in the receiver shall put the engines into motion a little distance before the charge is ignited, with the result that there is no fear of their failing to start. The engines are driven by town gas; and, as evidence of their economy, it may be mentioned that the dock was recently emptied within 1¼ hours, at a cost of less than 6s. 9d.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Buxton.

The One Hundred and Third Quarterly Meeting of this Institution was held on Saturday last at Buxton. The party, which set out from the Central Station, Manchester, arrived at Buxton at about 11 o'clock; and they were then conveyed in coaches to the gas-works, of which an inspection was made under the guidance of Mr. GEORGE SMEDLEY, of Buxton, the President, who explained the various features of the works, in which the members were greatly interested.

Before leaving the gas-works, the party were joined by Mr. E. C. MILLIGAN, the Chairman of the Gas Committee, who extended a very hearty welcome to the visitors on behalf of the Committee. He said he should like to have been with them earlier, and heard their expressions of opinion upon the various parts of the undertaking, in which he had taken a good deal of interest; but he had been prevented. The gas production in Buxton had once been—when his father was Chairman of the old Gas Company before the transfer—only a very small affair; but now the concern was in a very satisfactory condition. The financial position was, however, now a very good one. They had in Buxton good gas; the independent analyst who reported on the matter said the average quality was about 20 candles, and the cost to the public was 2s. 6d. per 1000 cubic feet net. He (Mr. Milligan) thought this was very satisfactory for a small place like Buxton, especially as they paid a high price for coal. The profit obtained on the gas undertaking was about £1000 a year, which helped to reduce the rates to the extent of about 4½d. or 5d. in the pound. He supposed Mr. Smedley had been indebted to members of such societies as theirs for a good many hints in the course of his work. One of the most beneficial effects of the meetings of such Associations certainly was that any member who was deficient in some particular respect could receive assistance from others; and he thought the public generally owed many thanks to the members of their own and similar societies for the various improvements that had been made in gas production, which had helped to reduce the price at which it could be supplied. He again welcomed the members heartily to Buxton, and hoped their short stay there would benefit them. He also wished success to the Association with which they were connected.

Mr. JOHN CHEW, in moving a vote of thanks to Mr. Milligan, Mr. Smedley, and their Secretary (Mr. S. S. Mellor) for the arrangements made for the reception of the members, said he had known their President for the past twenty-five years; and when he heard some of the figures the Chairman had given them, and thought of the condition of the Buxton gas supply ten years ago, he was amazed at the progress made. They had reduced their capital from £60,000 to about £45,000, and were now producing gas to supply at 2s. 6d. per 1000 feet; and when they compared this with the cost of gas in some large cities, and also noticed the quality of the coal used, they could not but think the Buxton undertaking a success, and that Mr. Smedley had done credit both to himself and to the works with which he was connected. In regard to the object of the Association, it was certainly their aim to help each other over the stepping-stones. He must again say that the success of the Buxton Gas-Works reflected the greatest credit on the Gas Committee, the Chairman, and Mr. Smedley, the President of the Institution. He had much pleasure in proposing the vote of thanks to them.

Mr. ISAAC CARR seconded the proposal. He said his only regret was that the attendance of members was not larger; but it was then just in the middle of the holiday season. He had been greatly struck with the appearance of the gas-works, which were excellently equipped and well arranged; and he was pleased to have had an opportunity of inspecting them. That the arrangements were acting satisfactorily was proved by the low selling price of 2s. 6d. per 1000 cubic feet, out of which, he understood, a good profit was being made.

The vote of thanks having been carried, with acclamation,

Mr. MILLIGAN, in responding, paid a tribute to the work done by Mr. Smedley, who had brought the undertaking into such a satisfactory condition. He was pleased to know they considered that Buxton had such nice little gas-works.

After further inspection of the works, the party were conveyed to the Royal Hotel, where luncheon was served. After lunch, the members held the business meeting—Mr. GEORGE SMEDLEY, the President, occupying the chair.

The HON. SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the previous quarterly meeting, which were confirmed.

Mr. W. Dickenson, of Hindley, near Wigan, was elected a member of the Institution.

Mr. R. G. SHADBOLT, of Low Moor, read a paper on

SOME EXPERIENCES IN GAS PURIFICATION.

In these times of strict economy and searching analysis, any method, simple or complex, which will enable the manufacturer to reduce the prime cost of his wares, be they in the gaseous, liquid, or solid form, is as a rule readily welcomed. Needless to say this is a rule which predominates the commercial world, and one to which we, as a body of manufacturers, are certainly no exception.

There are many things to engage the attention of greater magnitude and apparent importance, than the reduction of the labour cost of gas purification by a fraction of a penny per 1000 cubic feet; but it does not logically follow that it should be neglected on that account. The ordinary duties of a gas manager may be said to consist of a host of small things, few of which have a greater fascination for him than the purification of gas in closed vessels; and although one may not claim to have achieved this in its entirety, still a step in the right direction, however small, is sure to be of interest and benefit to those concerned. Therefore, at the invitation of our Committee, the writer purposes recounting some experiences in gas purification, more particularly respecting the use of air and steam as aids to the work.

It will be some eight years or so ago since we commenced experimenting at Fleetwood (being then with my father) in the use of air in gas purification. The purifiers were three in number, and getting rather small for their work. Two were used in the ordinary way—being changed alternately; and the remaining one was used as a check or catch box. Being unprotected from the weather, the work of emptying and recharging was not always of the most pleasant character; nor were the circumstances such as would conduce to the best working results. It was therefore with a view to reducing the one, and increasing the other, that attention was turned in this direction.

Operations were commenced by introducing atmospheric air into the gas at the foul main—immediately before the condensers; drawing it in in the orthodox fashion, by setting the exhauster governor to give a slight pull. At first, all seemed to go well; for, contrary to expectations, not only were the purifiers beneficially affected, but an actual and appreciable increase took place in the illuminating power of the gas. But, alas! this state of affairs was very short-lived; for, when once the coating of naphthalene, &c., on the inner side of the pipes and connections of the different apparatus had disappeared, and all become practically clean, our troubles began.

Naturally enough, an attempt was made to determine the requisite proportion of air to revivify the oxide of iron (this being the principal purifying material) without removal, and whilst in action. But there was no escaping the fact that the cost of enrichment required to counteract the ill effects of the resultant nitrogen upon the illuminating power of the gas, would be far in excess of the saving effected in purifying labour.

The next step was to ascertain if possible, what proportion of air the gas actually would take without increasing the cost for enrichment—thereby securing the greatest advantage possible from the partial, instead of complete, revivification of the oxide whilst in action. But very soon another drawback presented itself. Drawing in air by means of the exhauster appears quite feasible in theory; but, when put into practice, it is another thing entirely. It had become quite evident by this time that 1 per cent. of air was all the "watering" the gas would stand; but though this proportion was very carefully measured and checked, sudden and perplexing variations in the illuminating power of the gas were noticeable—these variations generally being on the "down grade." A little investigation clearly showed this to be attributable to the vagaries of the exhauster governor, which, although every care was taken to measure the air introduced at one particular point, often brought about the wholesale introduction of air at other places—to say nothing of furnace gases drawn in from the settings through cracks in the retorts. Then, again, the exhauster was of the steam-jet type; and by setting the governor to give a pull, an increased quantity of steam was required—reducing the strength of the ammoniacal liquor, which was sufficiently weak already.

Suffice it to say, this method of introducing air was abandoned; but after a short respite another was determined upon. This time the governor was set to give a level gauge, and the air introduced at the exhauster inlet—the point of least resistance—by means of a power meter. In this case, much more success was attained than in the other. The strength of the ammoniacal liquor was not unduly affected. A much more regular illuminating power was maintained, and the life of the purifier charges considerably extended. But, although a regular method of working was soon attained, it was not for very long; for, after changing the boxes once, we were again compelled to discontinue the use of air, owing to the caking of the oxide, with all its attendant disadvantages.

Some three-and-a-half years ago the scene of action was changed from Fleetwood to Low Moor; and it may not be considered out of place to briefly describe some of the apparatus found there. Considerable alterations and extensions had been carried out—including, amongst other things, four new purifiers each 20 feet square by 5 feet deep; and two catch or check boxes each 17 ft. 6 in. by 11 feet by 5 feet deep. The latter were constructed from four old purifiers replaced. The condensing and scrubbing plant was totally inadequate to meet the maximum requirements; and almost the first work to be carried out was the erection of new condensers, and the doubling of the capacity of the scrubbers. Prior to this, traces

of tar and plenty of ammonia found their way into the purifiers, which were then worked as follows: The four large purifiers were charged entirely with oxide of iron—three being in action at once, and one off for cleaning purposes; and the two check boxes, with lime only. Owing to the extension of the condensing and scrubbing plant, ere the winter season came on, neither tar nor ammonia could reach the purifiers. The oxide in use at that time being about spent, it became necessary to dispose of and replace it; and the selection of new oxide was rather unfortunate. Not only did it prove to be an oxide that fouled quickly; but, having been purchased rather late in the year, it contained an extraordinary proportion of water. Its unsuitable condition, along with the practically entire absence of ammonia from the gas, made the complete removal of the sulphuretted hydrogen almost an impossibility. In fact, had it not been for the judicious use of a little lime in each of the four larger boxes, it would have been quite so. As there was no way of escape, the only course lay in making the best possible use of what first came to hand. A considerable proportion of dry sawdust was thoroughly mixed with each charge after revivification, and the proportion of moisture quickly reduced. As soon as this was brought down sufficiently low, each charge—a few days prior to its return to the purifier—was well sprinkled with ammoniacal liquor of about 4° Twaddel; thereby increasing the life of each charge by from 80 to 100 per cent. Still, as the make of gas increased, it became a difficult matter to keep pace with the fouling material; and once more, atmospheric air was pressed into the service.

This time no definite proportion of air was admitted; but it was made to vary according to the illuminating power of the gas. The exhauster governor being set to give a slight pull, an open pipe was attached to the condenser inlet, varying in size from time to time as the quality of the gas would allow. This, of course, was but a temporary measure, to give relief when in a "tight corner"—sufficient nevertheless to again set one thinking.

Before proceeding further, it may be of interest to give the results of some laboratory experiments made in the early part of the present year on three different samples of oxide of iron, with a view to ascertaining what benefits were derived from the admission or addition of ammonia. The three samples used were one of Irish bog ore, and two of prepared hydrated peroxide of iron. These contained respectively 69·4 per cent. and 22·6 per cent. of free sulphur on the dry basis; the third sample being new and containing no sulphur whatever.

A sufficient sample having been taken from each of the three lots of oxide before mentioned, each sample was divided into two; one half being treated with water and the other half with dilute ammonium hydrate—sufficient in each case to bring the oxide to a proper state of moisture for use in purifying. Two test-tubes were used as purifiers—the first one a straight tube 8 inches long by 1 inch internal diameter; and the second one a U-tube 9 inches long by ½-inch internal diameter. Both tubes were filled with the oxide to be tested, and then connected to a service-pipe conducted from the main leading from the scrubbers to the purifiers. A No. 1 burner was attached to the outlet of the U-tube, which acted as a catch-box; and after the air had been driven out, the gas was there burned, giving a light about the size of a small pea. The flow of gas was continued through the test-tubes, at this rate, until it turned the lead test-paper at the outlet of the U-tube. The gas was then turned off; the oxide removed from the test-tubes—that in the U-tube being thrown away; revivified thoroughly; and then analyzed for free sulphur on the dry basis.

Each sample—three treated with water and three with dilute ammonium hydrate—was treated exactly in this manner; and the results obtained were as shown in the accompanying statement, Table A. These figures will, in the writer's opinion, account for many apparent inconsistencies between parcels of oxide obtained from the same source.

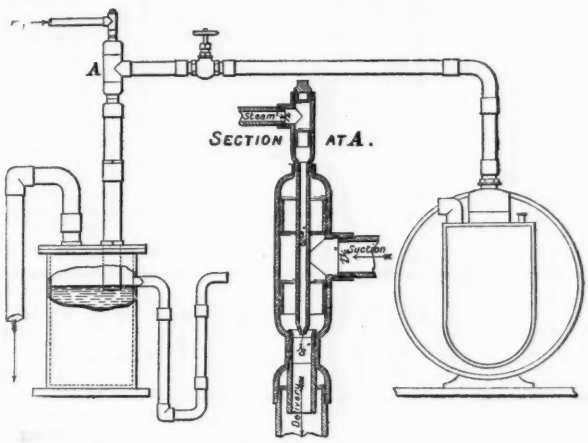
TABLE A.

Description of Oxide of Iron Used in Experiments.	Free Sulphur Contained before Testing.	Free Sulphur Contained after Testing Treated with Water.	Free Sulphur Contained after Testing Treated with Ammonium Hydrate.	Increase of Free Sulphur due to Treatment with Ammonium Hydrate.	Increased Duty due to Treatment with Ammonium Hydrate.
Irish bog ore .	69·40 p. c.	70·60 p. c.	72·00 p. c.	1·40 p. c.	116·66 p. c.
Prepared oxide	22·60 ,,	24·30 ,,	25·40 ,,	1·10 ,,	64·70 ,,
,, ,,	Nil.	6·10 ,,	10·90 ,,	4·80 ,,	78·60 ,,
					3)259·96
				Average increased duty . . .	86·65 p. c.

After pulling through the winter with the aid of ammonia and atmospheric air, and having to deal with gas practically free from ammonia, it was a matter for grave consideration as to whether atmospheric air could not be permanently and successfully utilized. After due reflection (fully bearing in mind past experiences), it was concluded that it should be done if the air could, by any simple means, be admitted into the gas at the inlet to the purifiers, where it would go straight to its work without in any way deranging, or interfering with, any other part of the plant or machinery, and would probably achieve the maximum amount of revivification with a minimum of resultant nitrogen. But, still, no means presented themselves for successfully dealing with caking oxide; and the matter was allowed to stand over for some time.

Last year it was the writer's good fortune to hear Mr. Dexter's paper read before the Incorporated Gas Institute, on the use of steam in oxide revivification, which resuscitated an idea that had been previously dismissed as likely to do more harm than good. It seemed likely that, by using live steam, instead of exhaust, much less would be required; and the pressure required could be utilized in some kind of an injector, which would, in the simplest manner possible, enable one to introduce the air against any back-pressure likely to arise, and at the point already decided upon—viz., the inlet to the purifiers.

The first step now was to devise a suitable injector. Suffice it to say, that the first attempt was almost successful; for, with but very slight alteration, the injector was made in the first instance as shown on the sketch. After testing it as to pressure and



vacuum, it was fixed in position close to the purifier centre valve, with meter, trap, &c., as shown. The first difficulty experienced was with the valve and float of the meter, which would suddenly close owing to sudden pulls of the injector caused by stray drops of water passing the nozzle of the steam jet. The valve and float of the meter were removed, and a throttle valve placed on the suction pipe of the injector; giving complete control of the whole apparatus. Owing to the air regulating valve, no more pull is put upon the meter than is actually required to work it. In fact, so easily does the meter work under this arrangement, that the water-level does not seem to be disturbed in the least. As the depth of winter drew near, and the make of gas increased, the maximum capacity of the injector, as then constructed, was arrived at; and after reaching that point, the more steam applied the more irregular it became in its action. The injector was taken out, and the length of the neck increased as shown; and no difficulty has since been experienced.

The delivery of the injector dips ¾-inch into water, as shown, giving a safety seal against 20 inches of back pressure; and any water in the mixture of steam and air is there deposited and trapped off. The stream of hot air and steam proceeds forward immediately into the gas-main, at a point about 9 feet from the centre-valve. It intermingles with the gas, and goes straight to its work.

The apparatus is visited once a day, at noon. The state of the meter is then taken, the water-line readjusted, and the quantity of air passing altered if necessary. It is perfectly under control; and any temperature between 80° and 200° Fahr. can be obtained by simply opening the steam-valve, and checking the air-valve for higher temperature, and *vice versâ* for lower temperature.

Perhaps the time when the greatest benefit accrued from the use of this apparatus was in the early part of the present year, during the severe frost, when the gas leaving the scrubbers was often much below freezing point, but entered the first purifier at a temperature between 90° and 100° Fahr., and this with the steam-valve unaltered.

The accompanying diagram [next page] will give a better idea of its effect upon the gas temperature than any wordy explanation. The temperatures there shown are at the inlets to the first and second purifiers, station meter, and of the atmosphere; and they extend over the six months ending July 31, 1895, including the coldest and warmest parts of the present year. The proportion of air admitted to the make of gas was 1½ per cent., until January this year, when it was increased to 2 per cent., after making sundry tests, as shown in Table B. As 2 per cent. of air extended the life of each purifier charge by six times, and 1½ per cent. of air only three times, and 2 per cent. caused only an infinitesimal diminution in the illuminating power of the gas, 2 per cent. of air has been admitted since January, in preference to 1½ per cent. The apparatus has been working altogether ten months—the first three months with 1½ per cent. of air and the last seven months with 2 per cent.

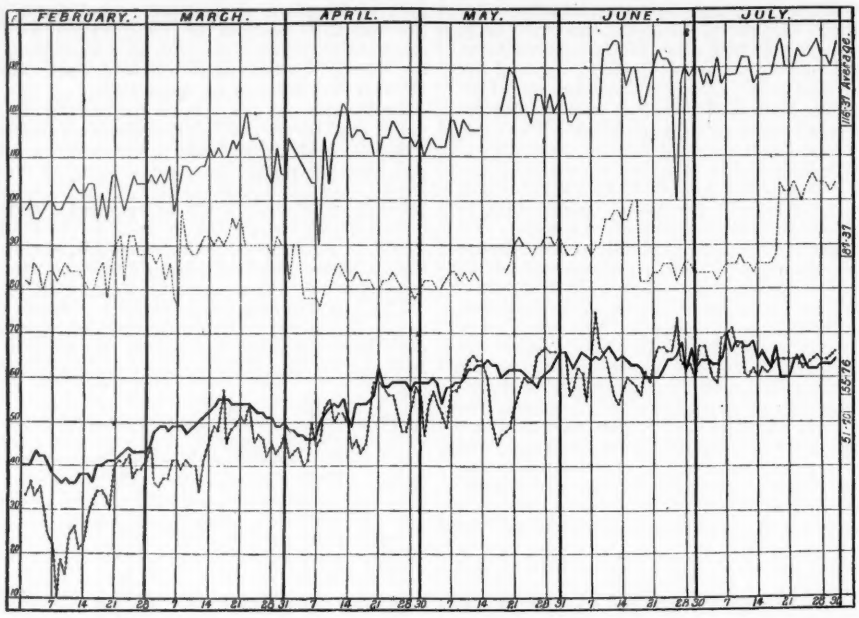


TABLE B.

Proportion of Air.	Illuminating Power of Gas without Air, in Standard Candles.	Illuminating Power of Gas with Air, in Standard Candles.	Decrease in Illuminating Power, in Standard Candles.	Decrease in Illuminating Power.
1½ p. c.	17·23	17·23	Nil.	Nil.
2 „	17·60	17·49	0·11	0·62 p. c.
2½ „	17·60	17·20	0·40	2·21 „

The temperature of the gas is perfectly under control. No extra back-pressure is given, however long the charge may run; and the removal of the material when fouled is accomplished without any extra difficulty. Neither the quantity of gas purified per charge, nor the percentage of sulphur taken up, has been here given, as it would be unfair to the oxides now in use—one half being natural oxide, containing 60 per cent. of sulphur on the wet basis, and the other a prepared oxide upon which experiments are being made respecting the best proportion of moisture at which to work it. It is hoped, however, that this will be sufficient excuse for a little reticence in this respect.

In conclusion, it may be said that the injector, as here shown, is quite capable of dealing with greater pressures than are ever likely to arise, and with a much larger quantity of air than has been requisite in the present case.

Discussion.

Mr. JOHN CHEW (Blackpool) said he should like to know what were the advantages claimed for the use of steam. Mr. Shadbolt had given some very interesting particulars as to the use of air rather than the use of steam. He (Mr. Chew) had read Mr. Dexter's paper—referred to by the author—and he thought it very interesting. With regard to enrichment, he should like to know whether it was Hawkins's enrichment process that was referred to.

Mr. SHADBOLT: Ordinary enrichment; cannel enrichment.

Mr. CHEW (resuming) said the author stated that he used from 1½ to 2½ per cent. of air. With regard to his (Mr. Chew's) experience, he had very large oxide purifiers, also lime purifiers, which were ordinarily worked against 2 inches of back-pressure; and last year he had the misfortune to have an explosion owing to the oxide becoming coated by tarry matter. The reason was that the Livesey washer trays had become ineffective. This year he resorted to the Pelouze and Audouin condenser, and had the trays renewed, and new grids and sieves put in; and he now experienced no difficulty. He might say that he ordinarily used about 1½ per cent. of air, which was, in his opinion, as much as could be put in, without endangering the illuminating power of the gas. If lime was used for purifying, the foul lime, when put out into the air, would cause a public nuisance; and with regard to oxide, when the heat from it was being given out, it became very offensive indeed. The object of introducing air was, in many cases, not to gain anything specially, but to mitigate the smells given off by oxide when it was thrown out of the purifiers. By using 1½ per cent. of air, he made the purifiers last as long again as without it. If the steam process would break up the tarry coating at the bottom of the oxide, which was often found, it would serve a good purpose. From what he could gather, practically nothing had been absolutely gained by the use of steam,

Mr. SHADBOLT: It prevents back-pressure, and supplies the motive force for injecting the air.

Mr. CHEW said he used an ordinary Roots blower, which was as regular as clockwork. There was often a danger of the back-pressure coming on suddenly. He remembered one day when at 6 o'clock the ordinary working pressure was only about 18 inches, in a few hours it was 70 or 80 inches, which was caused by the caking of the oxide at the bottom of the purifier—not that his purifiers were small, by any means. If this was avoided by using steam, it would be a good thing. Personally, he was very chary about discussing the introduction of air into gas, as the public, immediately they heard "air" mentioned, thought the object of those responsible for the manufacture of gas was simply to increase the consumers' bills. Gas engineers had to fight against such prejudices on the part of the public. He need not say they were entirely without basis, as regards any honourable member of the profession. However, as the public had this opinion, they must be careful, when speaking about introducing air, as to how they dealt with the matter.

Mr. ISAAC CARR (Widnes) said, though he much regretted that Mr. Shadbolt had been prevented from reading his paper before, he was pleased to know that the delay had allowed him to extend his observations. To his own mind, the lesson of the paper was in a nutshell. It was that the work of the purifiers could be greatly increased, and profitably increased, by the introduction of air, moistened by steam, instead of the introduction of air alone, as had been the common practice in years past, at the hydraulic main or the condensers. He had himself been trying to arrange for experiments on these lines; but he had not yet been able to put them into effect. He should certainly, however, after the reading of Mr. Shadbolt's paper, introduce air by means of a steam injector, at the inlet of the purifiers, instead of the old stereotyped method of drawing it in at the inlet of the exhauster.

Mr. CHEW said he drew the air in at the outlet of the condenser, and used a Roots blower for the purpose, and a small engine which regulated the operation to a nicety.

Mr. J. BRADDOCK (Radcliffe) observed that he had had some little experience during the last few years in methods of prolonging the life of purifiers; but he had not come to quite such an elaborate system as had been presented in the paper. His efforts had recently been in the same direction; but they took this form—that he introduced the steam at the inlet of any one of his four purifiers, and not at the main inlet through the centre-valve. His reason for doing this was that, by bringing the air in through the centre-valve, the valve (which was of peculiar construction) was affected by the heat of the steam to a deleterious extent—owing, perhaps, to the heat setting up unequal expansion. Whatever might be the cause of this, he dispensed with the previous arrangement, and now introduced the air to any one of the four purifiers that he cared to apply it to. It certainly had a beneficial effect, not only in prolonging the life of the purifier, but in very considerably preventing the caking of the oxide; and instead of having, at this time of the year, to use the pick and spade, the spade itself was quite enough. Another advantage was that the purifier was not so objectionable to the men as it would be under ordinary conditions. In regard to illuminating power, he was at present using about 2 per cent. of air; and it was only at this time of year that he could use such a percentage. If it were continued to the busier season, it would prove very unsatisfactory.

Mr. A. SHEIRS (Kidsgrove) said he was at present considering the question of alterations at his works; and he should have liked more information on this matter than the author had given. In his case, the gas entered the condensers at 147° Fahr., and

left at 60° Fahr. After going through the exhauster and the washer-scrubber, he found that at the outlet of the purifier it increased to 90°, and then decreased to 55°. By introducing steam, caking took place; and this caused some choking or back-pressure, bringing on a stoppage of the purifiers—the water blowing out of the lutes. He did not know whether he was using the proper quantity of steam; but he certainly found that the material caked and caused back-pressure.

The PRESIDENT said the paper had been specially interesting to himself. It was about 11 years since he first introduced air into his purifiers. He then used Hawkins's patent, which was simply an air-pump—the quantity of air being measured into the purifier according to the make of gas. The air was passed through a chamber containing all the tar that was made on the works; and heated up to 75° or 80°. The air was then passed direct into the purifiers; and, he must say, he found great benefit from doing this, as it made the purifiers last twice as long, and effected a great saving of labour. This went on for a number of years, until in 1894 the shaft of his washer-scrubber broke, and he was compelled to pass all the gas direct to the purifiers. Then, whereas prior to this occasion the ordinary work of the purifiers had been about 750,000 cubic feet, the first purifier after the breakdown of the scrubber purified about 5,966,000 cubic feet—lasting about 21 days. The second one ran for 31 days, and purified about 6,000,000 cubic feet. He read the paper by Mr. Dexter (referred to by the author) on the injection of steam into the purifiers; and first of all he injected the steam as near as possible to the air-pump. But in this case, he did not find much benefit, because the steam was so far condensed before it arrived at the purifiers that it was ineffectual. He might say that the temperatures he could get with his purifiers had been 65° to 70° upon the foul purifier. He then set to work, and injected the steam with Hawkins's pump, close to the valve of the purifiers; and he could then raise the temperature up to 95° or 100°. Since he had done this, he could run the purifiers as long as he thought proper, without any back-pressure, and the average work was about 2,000,000 cubic feet. He was now convinced, from what Mr. Braddock had said, that the proper way to inject the steam was into the bottom of each purifier, and then the temperature—which had a great deal to do with all chemical processes—could be increased to at least 100°, and thus the oxide would do its work better. He was satisfied that the author was going in the right direction, and that Mr. Braddock had given a valuable suggestion.

Mr. SHADBOLT, in replying to the discussion, thanked the members for their complimentary opinions, which would induce him, if again called upon to bring forward a paper, to do so with pleasure. With regard to Mr. Chew's remarks, he might say that prior to Mr. Dexter's paper he had been deterred from trying the steam process, owing to several gentlemen he knew saying it would not act. But Mr. Dexter convinced him. With regard to Mr. Dexter's paper, however, that gentleman had, he believed, some kind of steam-scrubber similar in construction to an annular condenser, which cost a good deal of money, and therefore could not be used in such works as his own. A £5 note would pay for the whole affair that he had described, and it could be made to turn out enough gas for ten works like his own. The matter of cost was therefore an important item. In Mr. Chew's case, the 1½ per cent. of air he admitted, extended the life of the purifier to twice its previous life. In his (Mr. Shadbolt's) case, it increased it three times; and 3 per cent., six times. The question as to the non-caking of oxide was one of the special advantages of steam. Mr. Braddock's experience with the centre-valve was most remarkable and exceptional. Mr. Sheirs's case was exceptional. He (Mr. Shadbolt) should fancy that with the gas entering the purifiers at 80°, it would probably have not only light, but heavy oils in it before it reached there, and the steam injected would convert it into a kind of pitch, which would prevent the progress of the gas almost immediately. Of course, they must remember that the conditions varied with each works; and no doubt, if the whole of the conditions at Mr. Sheirs's works were understood, the difficulty could be removed. The President's remarks bore out his own experience. He might add that, if they allowed too much ammonia to go through the purifiers, pressure would be produced. It was all a question of proportion. There was still a good deal to learn about gas purification; and he was glad they thought his paper had given them some useful suggestions.

Mr. MELLOR proposed a vote of thanks to Mr. Shadbolt.

Mr. MERRELL seconded the proposal, which was supported by Mr. CHEW, and heartily accorded by the meeting.

THE EXCURSION.

Immediately after the close of the meeting, the members made an excursion, in coaches, to the "Cat and Fiddle," returning *via* Axe Edge. On reaching Buxton again, tea was served at the Royal Hotel. At the close,

The PRESIDENT expressed his pleasure at meeting the members in the town with which he was connected. He was glad they had chosen Buxton for their visit; and he hoped they had both learned something and enjoyed themselves during their short stay. He only regretted there were not more present.

A vote of thanks was unanimously accorded to the President, Mr. Milligan, Mr. Isaac Carr, and the Secretary, for the arrangements they had made for the convenience and enjoyment of the members, and the proceedings closed.

SOCIÉTÉ TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.

Further Abstracts of the Papers.

(*Concluded from p.* 436.)

The sale of coke locally was the subject of a paper by M Ymonet, who explained the means adopted at Rennes for developing this branch of the Gas Company's business. At the outset, he laid down two propositions—viz., that coke should be offered to the working classes at their doors at the same price as at the works; and that the middle classes should be afforded every facility for sending their orders to the works in full confidence that they would be executed with but little delay. After making a trial, in an outlying locality, with a small coke-store which was thoroughly successful, the town was divided into four districts, in each of which there was established a similar store capable of containing from 600 to 700 bushels of coke in sacks. Each of these stores served as the residence of the lamplighter, whose wife, when he is away, sells the coke by retail for ready money, and receives orders for transmission to the works. During the spell of very cold weather from Jan. 1 to March 31 last, the coke sales reached 17 per cent. of the total local sale. The price charged is the same as at the works. Keepers of tobacco-shops are also utilized for the receipt of orders, which are collected by the lamplighter, and forwarded to the works. During last year, the orders obtained in this way reached 13 per cent. of the entire local sale. The service is so regulated that at six o'clock in the morning the yard foreman knows exactly how to prepare his deliveries for each district. The outdoor men also assist in the work; being provided with price-lists, and so forth, so as to be in a position to take orders. Last year, 16 per cent. of the local sales were effected through their agency. The tobacco-shop keepers are allowed about 6d. a chaldron, and the Company's servants about 3½d. for the same quantity. The store-keepers get 4 per cent. on the small sales for ready money. With regard to delivery, which has caused some trouble, the following rule has been adopted: Delivery at the house to be understood to mean that the coke is to be deposited in the cellar; but quantities of less than about 14 bushels may, at the request of the customer, be taken upstairs. In no case, however, are the carters to be expected to carry the coke up to the attics, owing to the dangers attending it. As to the method of dealing with the coal merchants, the Company allow them 10 per cent. on the selling price, and give them a bonus of a bushel for every 12 bushels of coke sold. These terms are good enough to keep the merchants from buying coke coming from outside sources. From next winter, merchants will be allowed a small supplementary premium. For the first quarter of the current year, the coal merchants disposed of 34 per cent. of the coke sold locally; the orders received at the works or at the office reaching 37 per cent. The author closed his paper with the confident expectation of an assured local sale, under good conditions, of almost the whole of his coke.

M. Ymonet also described a safety appliance for sending gas into the holder by the outlet-pipe, in the event of the accidental closing of the inlet. He acknowledged having obtained his idea from the apparatus devised by M. Coindet for preventing the extinction of gas in the town as a consequence of the stoppage of the outlet. In appearance and construction, M. Ymonet's appliance very much resembles a station governor; and, like that of M. Coindet, the bell has a rack which prevents it falling unless operated by an attendant. The arrangement of the author's governor-house was shown by a drawing. It contains two horizontal pipes placed end to end, but separated by a bye-pass valve. One of the pipes has upon it all the gas-holder inlet-valves; the other, all the outlet-valves and also the pressure-regulators. No error is likely to result from this arrangement, as all the valves are within easy reach of the attendant, who has not, as in the case of some works, to go from one holder to another. The two appliances—M. Coindet's and the one devised by M. Ymonet—are in operation at Rennes, and prove an effectual safeguard against accidents. They are both stated to work with great precision; and they are so sensitive that, during the intense cold of last winter, they served as indicators of the presence of ice in the gasholder tanks. The racks might be connected with electric signals, so that if either of the appliances began to work, the attendant would be at once apprised of the fact.

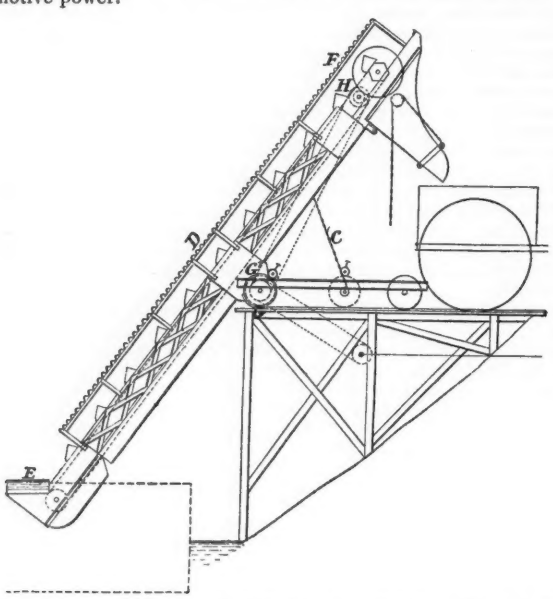
A new kind of circular street lamp was described by M. Chauveau, its inventor. Its consists of a metal framework and cover; but the glazing, instead of being of ordinary glass, consists of glass tubes, with a piece of glass at the bottom. For cleaning purposes, or for replacing the tubes, all that is needed is to raise the cover on its hinge. The spaces between the tubes are so small as not to allow the passage of wind or rain; and, moreover, the cylindrical form of the lantern does not leave many spaces exposed to the direct force of either element. Consequently, the light burns steadily even in a violent storm. The advantages claimed for the new lamp are: A better utilization of the light by reason of the comparative absence of shadows; the enlargement of the flame; a more equal distribution of the light in every direction owing to the multiplying effect of the glasses; and the reflecting property of the cover, which is whitened inside. The lantern may be used for gas, oil, or electric lighting.

The employment of incandescent gas-burners in public

lamps has led MM. Borias and Dutertre to devise a practical method of lighting them, whether singly or in clusters. The arrangement for a single burner comprises a lamp-base, a lighting-cock, and a wind-guard, with or without a reflector. For lamps containing more than one burner, a flame-carrier is added, which is movable around the principal burner-holder, or can be made to pass under all the burners in a circle. M. Borias has also devised a dry isolator to aid In discovering escapes of gas.

In a short "Note" by M. Henri Villiers, he summarized recent publications dealing with the subject of the deterioration of gas-pipes laid in proximity to electric tramways, and reviewed the various methods of electrical installation which are favourable or otherwise to the preservation of the pipes. Having explained the phenomena, he stated that at certain points the current passes from the pipes to the rails, and *vice versâ*. This sets up electrolysis; and the gas-pipes are attacked at the points where they are positive in regard to the rails (in other words, where the current leaves them), but never where it penetrates them. Very interesting investigations of American engineers have indicated the cases where the danger is greatest; but they have not pointed out the infallible remedy.

M. de Billy submitted to the meeting a short paper, in which he brought under the notice of the members an appliance for discharging coal-barges, for which he claimed certain advantages as compared with the steam or the hand crane. In the first place, the former is costly to instal; then it is very liable to cause accidents, owing to its having to be worked at high pressure; and, lastly, it is exposed to the rigorous weather of winter. The hand crane, while furnishing a partial solution of the difficulty, is not altogether satisfactory; and, moreover, it cannot be employed when the distance from the water to the bank is considerable. After turning his attention to various machines, the author fixed upon the one shown in the accompanying illustration. He commended it as being simple in construction and economical in working; while another point in its favour is that it affords an opportunity for further utilizing gas for motive power.



The French Department of Roads and Bridges object to the erection of any fixed machine upon wharves. It was therefore necessary to make the appliance portable. It consists of an ordinary chain of buckets, mounted, at a point close to its centre of gravity, upon a carriage, and so contrived that the lower portion E D is rather heavier than the upper part D F. Its inclination is regulated by means of the chain C, which passes round a winch. It can therefore be easily raised or lowered as the barge rises or falls with the tide. Motion is given, by the cog-wheels G G^1, to the pinion H, and thence to the chain of buckets. The action of the chain is continuous, whatever may be the angle of inclination of the elevator; the distance between G and H being always the same. At the upper end of the machine, there is a receptacle, having a capacity of 12 to 14 bushels, closed by a trap-door, movable by hand, wherein a quantity of coal can be stored pending the replacement of one truck by another. This continuity of motion allows about 100 tons of coal to be unloaded in twelve hours with a 1-horse power engine; whereas one of 12 to 15 horse power would be required to do a similar quantity of work with a crane. The coal is shovelled into the hopper, which is so constructed that it can be filled from all points. The barge, therefore, has not to be moved more frequently with this appliance than with a crane. If the stores happen to be close to the wharf, the coal can be deposited, at a height of 8 or 10 feet, on endless bands, and distributed in the sheds, so as to save the cost of wheeling, estimated at about 2d. per ton; or, as in the author's case, it can be shot into waggons which are run up to the stores, raised to a height of 10 feet, and then discharged in a heap without further handling. Motive power, if easily procurable, might be furnished subterraneously, or electricity transmitted, for working the elevator. If these means were impracticable, a gas-engine could be fitted on the carriage of the machine itself. This would probably be the most economical arrangement. The appliance is suitable for gas-works receiving by water at least 4000 tons of coal per annum; and the author believes that its installation would be productive of considerable economy in the cost of unloading.

A short paper by M. le Roy contained a description of a portable trestle to facilitate the charging of retorts with the scoop. The author found that the stokers usually raised the fore part of the scoop too high, and then let it fall sharply upon the casting of the mouthpiece; thereby shaking the retort, and causing the joints to become defective and leaky. The portable trestle almost entirely gets rid of this trouble. Instead of the scoop filled with coal resting on the retort, it is supported on a movable roller of cast iron, placed in the projecting portion. The labour of getting the scoop inside the retort is considerably diminished, as it is, so to speak, drawn along mechanically by the roller turning freely upon its axis. The trestle consists of two double T-shaped iron uprights, connected above and below by two round iron bars strongly bolted, so as to give great rigidity to this part of the trestle. The base rests upon a flat iron frame, fastened to the two uprights by strong bolts, and supporting at each of its extremities two iron cheeks, in which are fixed four small wheels, carrying steel blades for clearing away the coke. An iron traction-rod, fixed to one of the uprights, enables the trestle to be easily moved backwards or forwards. The portion of the appliance of most interest is the roller, which turns readily when touched by the scoop. This is easily withdrawn after the charge has been deposited. By the use of the trestle, the men have to endure much less fatigue than without it; and very little time—twenty minutes at the most—is required to charge an ordinary setting of seven retorts with about 2000 lbs. of coal. The author has found in practice that the appliance works regularly, without requiring repair.

M. Delahaye presented a "Note" on the consumption of coa in central electric supply stations in the United States. It was explanatory of a table reproduced from the report of the proceedings at the last meeting of the National Electric Light Association, held at Cleveland (Ohio) in February. The figures were obtained by the Committee on Data of the Society; and though a smaller number of stations are given than in previous reports, they consider the particulars furnished are more accurate. Taking the average of the figures for ten stations, each supplying upwards of 5,000,000 watts per 24 hours, the yield of electricity is 147·5 watts per pound of coal, or one electric horse-power-hour per 4 lbs. of coal.

The use of acetylene for the production of lighting gas was dealt with in a paper by M. Bullier. He gave an account of the researches of M. Moissan, M. Berthelot, Mr. Willson, and others, in connection with the production of calcium carbide; and discussed the claim to priority as between the first and the last named investigator. He thought the credit for the discovery must be given to M. Moissan, in whose researches he had taken part. Convinced of the commercial importance of the substance in question, M. Bullier, in 1894, patented a method for its preparation. He dwelt particularly upon the fact that, the carburets obtained by his process being producible at a price which is a function of the motive power necessary to generate the electric current, he could obtain considerable quantities of them, which would be capable of subsequently producing acetylene at a moderate price, and that the application of this material then became practicable. He specially indicated lighting as one of the purposes to which it could be put. He went on to say that, if an attempt is made to burn acetylene at ordinary pressure, the resulting flame is smoky and red—this tint being due to the carbon resulting from the decomposition of the acetylene, which escapes combustion, and which consequently cannot be utilized in flames as an incandescent body. In the presence of this large excess of carbon, which seemed to render illusory the employment of acetylene as a lighting medium, M. Bullier sought first of all to increase the luminosity of gases already possessing light-giving power. The results of these researches were embodied in a patent taken out in the early part of the present year. M. Berthelot has established the fact that acetylene is an endothermic body. It is known, moreover, that, when diluted with air, it is capable of forming with oxygen explosive mixtures which are extremely dangerous. M. Bullier accordingly diluted it with an inert gas. Eliminating wholly or partially the oxygen of the air, and taking nitrogen alone (or even mixtures of nitrogen containing only from 3 to 4 per cent. of oxygen), he succeeded in suitably diluting acetylene to allow of its application to lighting purposes by means of the appliances ordinarily employed. Other inert gases, or mixtures thereof, may, however, be substituted for nitrogen, without increasing the net cost. In the author's laboratory in Paris, he determined the photometric values of different mixtures. A compound of acetylene and nitrogen, in the proportions of 85 per cent. of the former and 15 per cent. of the latter, consumed at the rate of about 3 cubic feet per hour, gave a light equal to 190 candles. With a smaller consumption—for example, 1·75 cubic feet—from a batswing burner, a mixture of 70 per cent. of acetylene and 30 per cent. of nitrogen had a

luminous intensity of 70 candles. The following table contains the results of burning acetylene in various mixtures and with different burners:—

Percentage Composition of Mixture.	Burner.	Consumption in Litres (100 litres = 3·53 c.f.).	Luminous Intensity in Carcels (1 C.=9·5 Candles).
Acet., 85; N., 15·0	Bray, No. 2	90	20·00
„ 85; „ 12·0; O., 3·0 (air).	„ „	90	19·00
„ 80; „ 19·0; „ 1·0	„ „	90	18·00
„ 65; „ 31·3; „ 1·7	„ No. 1	80	13·00
„ 70; „ 24·0; „ 6·0 (air).	„ No. 2	104	18·00
„ 80; „ 19·0; „ 1·0	„ „	84	16·00
„ 100	Batswing, No. 2	50	12·00
„ 85; „ 15·0	Bray, No. 1	80	16·00
„ 85; „ 15·0	Batswing, No. 2	50	10·00
„ 65; „ 31·3; „ 1·7	Bray, No. 2	95	14·00
„ 85; „ 12·3; „ (air)	Batswing, No. 2	50	8·50
„ 80; „ 19·1; „ 0·9	Bray, No. 2	100	18·00
„ 70; „ 30·0	„ „	90	13·50
„ 70; „ 30·0	Batswing, No. 3	90	14·00
„ 85; „ 12·0; „ 3·0 (air).	„ No. 1	50	9·50
„ 85; „ 12·0; „ „	Bray, No. 1	80	15·00
„ 70; „ 24·0; „ 6·0 (air).	„ No. 2	97	15·00
„ 50; „ 40·0; „ 10·0 „	Batswing, No. 5	120	13·00
„ 80; „ 19·0; „ 1·0 „	Bray, No. 1	84	14·50
„ 50; „ 40·0; „ 10·0 „	Batswing, No. 7	160	17·00
„ 50; „ 40·0; „ „ „	„ No. 6	142	15·00
„ 80; „ 19·0; „ 1·0	Bray, No. 1	73	12·00
„ 65; „ 31·3; „ 1·7	„ No. 2	82	17·00
„ 50; „ 40·0; „ 10·0 (air).	Batswing, No. 11	65	17·00
„ 70; „ 30·0	Bray, No. 1	80	10·50
„ 100	„ No. 2	70	14·00
„ 100	„ No. 1	79	16·00
„ 70; „ 30·0	Batswing, No. 1	50	7·00
„ 70; „ 30·0	„ No. 2	60	8·50
„ 70; „ 24·0; O., 6·0 (air).	Albo-car., No. 1	92	13·00
„ 70; „ 24·0; „ 6·0 „	Batswing, No. 8	146	19·00
„ 50; „ 40·0; „ 10·0 „	„ No. 10	150	15·50
„ pure	„ No. 11	42	8·00
„ 70; „ 24·0; „ 6·0 (air).	„ No. 4	140	18·00
„ 50; lighting gas, 50	Albo-car., No. 1	50	7·50
„ 70; „ 24·0; O., 6·0 (air).	Batswing, No. 3	102	13·00
„ 100	Albo.-car., No. 1	64	11·50
„ 65; „ 31·3; „ 1·7	Batswing, No. 1	44	5·00
„ 100	Albo.-car., No. 2	92	16·00
„ 50; „ 40·0; „ 10·0 (air).	Batswing, No. 4	103	9·00
„ 50; lighting gas, 50	„ No. 2	70	7·75
„ 75; carbon dioxide, 25	Albo.-car., No. 2	90	11·00
„ 50; nitrogen, 50	Batswing, No. 7	135	10·50
„ 100	Albo.-car., No. 2	53	8·00
„ 50; N., 40·0; O., 10·0 (air)	Batswing, No. 3	80	6·00
„ 50; „ 47·5; „ 2·5	„ No. 1	40	3·00
„ 50; „ 50·0	„ No. 6	130	9·50
„ 50; „ 50·0	„ No. 5	120	8·50
„ 50; „ 40·0; „ 10·0	„ No. 8	100	6·50
„ 70; „ 24·0; „ 6·0 (air).	„ No. 2	58	5·80
„ 100	Manchester	36	5·00
„ 50; „ 50·0	Batswing, No. 4	110	7·55
„ 50; „ 50·0	„ No. 12	100	7·00
„ 100	M. Bullier	17	2·30
„ 70; „ 30·0	Batswing, No. 1	51	5·00
„ 50; „ 40·0; „ 10·0	„ No. 2	45	3·00
„ 50; lighting gas, 50·0	Albo.-car., No. 2	100	11·00
„ 100	Batswing, No. 1	39	5·50
„ 50; N., 40·0; O., 10·0 (air)	„ „	38	2·15
„ 100	Albo.-car., No., 2	32	3·30
„ 50; „ 40·0; „ 10·0 (air)	„ No. 1	80	4·50
„ 100	M. Bullier	12	1·20
„ 50; „ 50·0	Batswing, No. 3	90	4·50
„ 50; „ 50·0	„ No. 8	110	5·50
„ 50; „ 40·0; „ 10·0 (air)	Albo.-car., No. 1	70	3·50
„ 50; „ 50·0	„ No. 2	90	3·70
„ 100	„ „	22	1·70
„ 50; „ 50·0	Batswing, No. 2	50	1·20
„ 50; „ 50·0	Albo.-car., No. 1	80	2·70
„ 50; „ 50·0	Batswing, No. 1	24	1·10
„ 50; carbon dioxide, 50·0	„ No. 12	70	2·10
„ 10; lighting gas, 90·0	„ No. 6	200	5·50
„ 10; „ 90·0	„ No. 1	52	0·90
„ 10; „ 90·0	Albo.-car., No. 2	100	1·10
„ nil; „ 100·0	Batswing, No. 1	50	0·20

The cost of the light depends solely on the price of carbide of calcium, which, as stated in M. Bullier's first patent, is a function of motive power. The raw material, being very widespread, is not costly. M. Bullier and M. Moissan put it at 150 frs. a ton. When acetylene was first introduced as a lighting medium, it was thought by some that danger would arise from its coming in contact with any copper employed in the existing appliances, and forming an explosive compound. M. Bullier regarded all these fears as exaggerated. He is justified by some experiments of M. Berthelot, who has proved that bright copper does not act upon acetylene. Moreover, M. Bullier has demonstrated its innocuousness by an experiment he himself carried out. He, however, found, as M. Berthelot had done before him, that iron burners are not suitable for the combustion of acetylene, as this gas is destructive to the metal, and causes enlargement of the holes. With regard to the alleged poisonous properties of acetylene, some doubt seems to exist. M. Bullier and his assistants manipulated large quantities of it during a period extending over several months; and they never suffered any inconvenience therefrom. M. Bullier concluded by remarking that lighting is not the only branch of industry in which acetylene gas can be utilized; while in the chemical arts acetylene itself is susceptible of numerous applications. This new discovery of the manufacture, by the aid of the electric furnace, of the crystallized carbides of calcium, barium, and strontium, allows of the production of a very luminous gas at a cheap rate, and at the same time assists the industries in which figure the salts of baryta or strontium.

M. Denayrouze showed to the members his incandescent burner, which was described in the JOURNAL for June 11 last (p. 1256), and was referred to in high terms by Professor Lewes in his paper read at the meeting of The Gas Institute in Edinburgh. M. Denayrouze lit a lamp of 760-candle power, the light from which was so brilliant as to be unbearable by the naked eye. It is stated that, with a consumption of 4 or 5 litres (say 0·14 or 0·18 cubic foot) of gas, an illuminating power equal to 9·5 candles is obtainable with this remarkable burner.

Gas-Engines and Electric Lighting.—The Battersea Polytechnic (says the *Daily News*) reports an achievement in electric lighting that looks almost too good to be quite reliable. It has been from the first lighted throughout by a complete installation on the premises, designed for 1100 lights in various parts of the building. There are two dynamos and a 12-horse power gas-engine; and it is reckoned that the glow lamps cost at a rate equivalent to only 1s. 9d. per 1000 cubic feet of gas. This result is so exceptionally brilliant that it is to be feared that something has been left out of the reckoning. It was calculated at the outset that, by running their own electric light, they would effect a saving representing 8 per cent. on the outlay; but if the light is obtained at the rate specified, they must surely be doing a good deal more than that.

The Cause of Fire by Electricity.—The chief of the Electrical Department of the Philadelphia Underwriters' Association (Mr. W. M'Devitt) recently gave a demonstration of some of the ways in which fires may be caused by electricity. According to the *Boston Transcript*, he showed that the first danger is that arising from the common practice of grounding telephone wires on gas-pipes. A bad connection is generally made—quite sufficient for telephone purposes—and then if the telephone wire becomes crossed with an electric light wire, the larger current meeting resistance at the ground connection heats the joint, makes a hole in the gas-pipe, and the arc formed lights the gas. Mr. M'Devitt gave a complete demonstration of the gas and insulation on the wire burning simultaneously. He also exhibited a section of gas-pipe that had caused a fire in this way. The wires in the sockets of electric lamps are liable to touch the casing, when an arc may be formed. For this reason, no drapery should be used around the lamp sockets. The advantage of using metal conduits with insulated lining through which to run the wire was demonstrated, a wire outside being dangerously heated, while from that inside the conduit there was no risk. A caution was given against rough handling of flexible cords used for electric lights as a common cause of short circuits and fire. There are other dangers due to ignorance on the part of the general public of the character of the electric current. In one case on record, the walls of a room were upholstered with stuff in which were interwoven a great number of metal threads. These were in contact with the electric light wires; and when the current was turned on, the whole room was set ablaze.

Received.—*La Technologie Sanitaire.* (Louvain: A. Uystpruyst-Dieudonné.) This is a new bi-monthly publication devoted to questions of water supply and applied hygiene. It is produced under the supervision of an Editing Committee, the Secretary of which is M. Victor J. van Lint, C.E., of Brussels. The two numbers to hand contain an article by M. Kemna, the Manager of the Antwerp Water-Works, on "Sand Filtration;" and a large instalment of one by Mr. Percy Boulnois, M.Inst.C.E., of Liverpool, on "Refuse Destruction." Reviews are included; and there is a bi-monthly international supplement, giving particulars of books, pamphlets, &c., on sanitary matters. The publication is of convenient size; and it will no doubt prove a useful addition to hygienic literature.——"Sulphate of Ammonia as a Manure." (Sydney: Turner and Henderson.) This is an illustrated pamphlet prepared by Mr. H. C. L. Anderson, M.A., Belmore Gold Medallist in Agricultural Chemistry at the Sydney University, and lately Director of Agriculture for New South Wales, in order to present in a concise form a few facts, obtained from the experience of practical and scientific agriculturists in Great Britain, Europe, and New South Wales, as to the manurial value of sulphate of ammonia. The illustrations show the marvellous effects resulting from the use of nitrogenous manures.——"Gas-Fitting." (London: Crosby Lockwood and Son.) This is the second edition of a practical handbook, by Mr. John Black, treating of every description of laying on and fitting gas. It is substantially a reprint of the first edition; but there is a supplementary chapter on recent improvements in burners, the incandescent system of gas lighting, "penny-in-the-slot" meters, and other modern developments of the mechanical side of gas supply. The book is one of Weale's Rudimentary Series; and the text is amply illustrated.——"Die Fabrikation der Mineralöle und des Paraffins aus Schweelkohle, Schiefer, &c." By Dr. W. Scheithauer. (Brunswick: F. Vieweg and Son.)——"Programme of Technological Examinations of the City and Guilds of London Institute, Session 1895-6." (London: Whittaker and Co., Paternoster Square.)

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting in San Francisco.

The Third Meeting of this Association, held on July 16 and 17, disclosed satisfactory progress. There are now 88 members, fifteen of whom were elected on this occasion; and more than half of the members were present. Mr. C. W. QUILTY, of San Jose, President for the year, occupied the chair.

In his Inaugural Address, the President said that, with regard to gas business on the Pacific coast, the past year had been one of growth, improvement, prosperity, and confidence. Though most of the coals used were imported, the district furnished oils that could be used for making gas; and large quantities of petroleums had been sent in from South American States for this purpose. Gas was now sold in San Francisco as cheaply as anywhere in the States; and most of their principal towns had been able to so far reduce the price as to secure a large amount of business for purposes other than lighting. Their climate was so equable, that a gas cooking-stove was a welcome domestic article all through the year; and there were no Eastern winters requiring coal fires for six months or so. Gas-engines were coming into use for various purposes; and in two places in California they were used for generating electric light. Speaking of acetylene, the President remarked that they had large water power, with good supplies of coal and limestone; and in no other part of the world were the conditions more favourable to its manufacture. Many towns and cities in their district were furnished with electricity from distant sources; and, with one exception, the plants installed for the purpose were the largest in the world. The greatest danger that threatened their industry was the propositions for municipal control and ownership. Where everything was quiet and satisfactory, the promoter would come along, and stir up the City Council to own a gas plant; and this would be carried out without reference to, or consideration of, existing vested interests. There was plenty of law for other interests, but none for the protection of a gas company; and he had drafted a Bill for this purpose, and distributed copies of it in pamphlet form. He urged the members to take up this question promptly and energetically; and he concluded by insisting on such a policy of cheap gas, moderate dividends, and skilled working as would leave no possible excuse or loophole for competitive gas schemes in their districts.

Mr. John L. Howard, the General Manager of the Oregon Improvement Company, contributed an entertaining paper on "Welsh Anthracite Coal." He commenced with a consideration of the theories respecting the formation of coal, and summarized the different classes of coal known, and their respective chemical constitutions. Comparing the composition of anthracite and coke, he called the former a natural coke, and proceeded to outline the position of the anthracite coal-fields in America and in South Wales. California was, he said, the only one of the States that imported from South Wales; and the reason for this was because the coal was brought back at a cheap freightage on the return journeys of vessels that took out wheat. The earliest importation was in 1883; and the gas companies were the first large patrons. The properties of Welsh anthracite for raising steam, and the best ways of using it for this purpose, were next considered in detail; and the reasons why many had failed to get satisfactory results from it were pointed out. But the freightage was now so low that Welsh anthracite was the cheapest steam-raising fuel obtainable in the district. Compared with oil at current rates, a dollar's worth of oil would evaporate 2905 lbs. of water; but a similar value of anthracite would evaporate 4293 lbs. For making water gas, a hard and well-screened coal was needed. But a softer kind would do for raising steam; and the importers were beginning to recognize the different qualities required in each case. Owing to the short time allowed for loading, it was difficult to obtain any special brand of anthracite; and the amount of breakage in the cargoes as received rendered it impossible to say whether or not it had been properly screened in the first place. The future supply of fuel to the district lay between bituminous coal from Vancouver Island, petroleum from California and Peru, and anthracite from South Wales; but it would be a rueful day for the Californian farmer if the latter was displaced. At present 800,000 tons of wheat were exported; and the effect of a loss of the freightage of coal on the return journey would be an increase of outward freights, which would render the present disadvantageous position of the Californian farmer even more deplorable.

Mr. Eichbaum, who claimed to be pioneer in the use of Welsh anthracite for water gas, remarked that when taking charge of the works belonging to the Pacific Gas Improvement Company, in 1883, he found about 20 tons of this kind of coal in stock, part of a cargo taken on trial. It was said to be useless, as it destroyed the grate-bars. On making a test, he found this was correct; and that it burnt down so close to the bars as to melt and destroy them. But he found this difficulty could be successfully met by placing about 6 inches of clinkers on the bars, in the first place, before charging the generator. It was quite true that the coal was not properly screened. Sometimes one-third of a cargo would pass through a ¾-inch screen. He used up the 20 tons, and then bought more; and the value of t soon became known. Mr. Britton agreed with the previous speaker. At Oakland, he had used Welsh anthracite for some years; but he could not get a settled brand, and also found that the screenings would come up to 35 per cent. of the whole. He was, however, able to use the small under a steam-boiler, with the aid of a forced draught. If the Welsh shippers could guarantee a known brand and a minimum of small, it would be an advantage. Mr. E. C. Jones said that his Company were large users of the material under discussion; and for some time the impression prevailed that it would not do for generators by itself, but must be mixed with patent coke. Some time ago, however, he happened to run out of coke, and then found that it could be employed alone with excellent results. He mixed the screenings with boiled tar, and used them for making steam. Mr. Britton said he formerly used patent coke, but found he could do better without it. With one-fifth coke and four-fifths anthracite, 38 lbs. per 1000 cubic feet of gas was required; but with the anthracite by itself, from 30 to 32 lbs. was sufficient. Mr. Allen said that Colorado anthracite was clean and free from small, but more costly than Welsh. He thought the Welsh coal was properly screened before loading, but that it broke upon the trip.

Mr. J. Bryant Grimwood, of San Francisco, followed with a paper on "Technical Gas Analysis," describing in detail the methods and apparatus employed daily at the North Beach Gas-Works in that city. These comprise Hempel's burettes and absorption bulbs. A 33⅓ per cent. solution of potassa, fuming Nordhausen sulphuric acid, sticks of phosphorus, and an acid solution of cuprous chloride are the chief reagents used. The hydrogen is oxidized, by passing it through a U-tube charged with about half a gramme of palladium black, mixed with asbestos fibre, and immersed in a beaker of boiling water. The marsh gas is measured by explosion in the usual way. Specific gravity is estimated by Schilling's apparatus.

After some further proceedings, Mr. T. R. Parker submitted a well-arranged collection of "Wrinkles," which he had received from members of the Association. Many of these serve to illustrate the proverb "Necessity is the Mother of Invention," as they show how temporary shifts can be made in out-of-the-way places, where there are no gas engineering works within hailing distance. One of the "wrinkles" is an arrangement for throwing water on the top of a gasholder, consisting of a perforated pipe carried round the top circle of girders. This is said to be useful in case of wooden buildings in the vicinity taking fire; and also for cooling the gas, if the holder is full and threatens to "blow" in the glare of the noonday sun. Another device is simple pressure and vacuum valves for oil-tanks, consisting of flat conical valves opening inwardly and outwardly respectively. A small cistern with float-valve, for automatically maintaining the correct level in water-meters, was also described. An apparatus for dissolving naphthalene consisted of a small tank, with sight-feed arrangement, intended to be charged with naphtha, and attached to the gas-main at the offending spot; and a regulated supply of naphtha is caused to drop into the main, where it vaporizes and destroys the deposit. One gentleman, careful for the comfort of his workmen, causes the drinking water to circulate in a pipe at the bottom of his gasholder tank; and thus reduces it 20° to 40° in temperature. The fact that gas managers on the Pacific Coast run high heats, is illustrated by two of the "wrinkles" applying to dealing with the mouth-pieces of retorts when the holding-bolts are burnt through. A charging car for the upper retorts, affording standing room for the stoker, is an ingenious device that is worthy of more extended adoption; as the proper placing of coals in top retorts is a general, and not a local, difficulty.

After the reading and discussion of several other papers, which dealt with matters of local interest only, and the consideration of the contents of the question-box, the meeting was brought to a close.

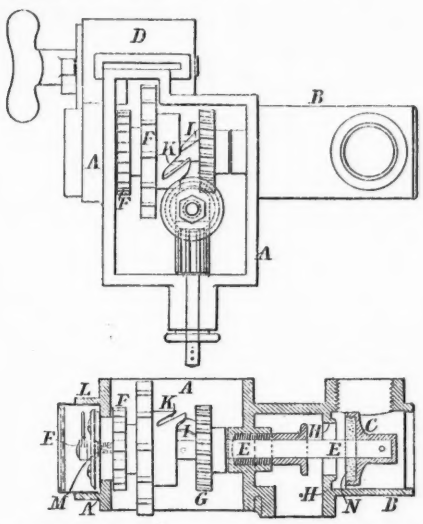
Motors for Horseless Carriages.—In the House of Commons on Monday last week, Mr. Macdona called the attention of the President of the Local Government Board to the recent performances of the petroleum motor owned by the Hon. Evelyn Ellis, and asked him whether he would consider the desirability of repealing the Locomotives Act of 1865, in order to permit of other than steam motors being more extensively used in the country. Mr. Chaplin replied that he had already noticed the matter, and intended to carefully consider it in connection with the Bill introduced by his predecessor last session.

Failures of Reservoir Dams.—A series of articles on reservoir dams in *Le Génie Civil*, by Mons. A. Dumas, contains an account of the principal failures of which authentic records are available. So far as earthen dams are concerned, M. Dumas finds the catastrophe has always arisen from one of the five following causes: (1) Perviousness of the dam itself, or of the ground on which it stands. (2) Insufficient size of the byewash leading to the water topping the bank. (3) The laying of pipes for drawing off the supply through the bank. (4) Wave action on the interior face of the dam, which in the case of large and deep reservoirs, exposed to strong winds, should be protected not merely by stone pitching, but by a bearing masonry wall on the inner slope. This wall should at the same time be made in comparatively small sections, so that unequal settlement shall not cause any serious dislocations. (5) The use of unsuitable material in the core.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Hawkyard, J., and Braddock, J., of Oldham. No. 17,706; Sept. 18, 1894.

This invention relates to improvements in apparatus described in patents Nos. 12,584 and 14,655 of 1890, wherein the meter supply-valve was fixed near one end of a spindle capable of an endwise and also of a revolving motion, and upon which spindle are fitted two wheels, to one of which motion is given direct from the action of the meter, and to the other motion is communicated by a coin in a reciprocating, oscillating, or revolving coin-receiver—the endwise motion, for opening or closing the valve, being imparted to the spindle by an inclined plane or cam surface on one wheel acting on a fixed projection on the other, or *vice versâ*.



The illustration shows a plan and a longitudinal section of the apparatus.

A is the outside casing; B, the valve-box; C, the valve; D, the coin-receiving box; and E, the sliding and revolving spindle of the apparatus, upon which the wheels F and G are mounted. The valve C is placed outside the seating H, with its face towards the wheels above mentioned, so that its closing movement can be obtained by a pull instead of a push or thrust. Another advantage is said to be that the frame A and the valve-box B and seating H can be all cast in one piece, if desired; and access may be had to the valve C for repairs or renewal, without disturbing the other parts of the apparatus.

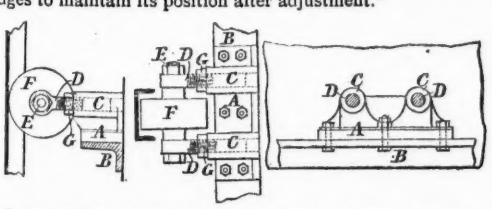
One of the wheels G is provided with a sloping projection or finger I, and the other with a corresponding sloping notch or slot K; so that when one wheel overtakes the other, the side of the notch acting against the side of the projection (or *vice versâ*) will thrust the wheels F and G asunder, or draw them together, and thus open or close the valve C, by giving the requisite endwise motion to the valve-spindle E. This closing motion is given by a forward pull, and the opening motion by a backward thrust as before described, without the necessity for any spring or other auxiliary. The wheel G is fixed on the valve-spindle E, and the end of the latter can both slide and revolve in a hole in the boss of the wheel F; the latter being prevented from moving endwise by a loose collar L, fixed by screws M.

By preference, the patentees make the stop-valve C of metal; and in the face of it there is an annular groove or recess, in which a ring N of yielding substance (preferably cork) is inserted; or the ring may be put round the outside of the metal face.

The seating H is made with an annular projection or rim, in order that the yielding substance N of the valve may come into contact with its seating just before the metallic surfaces meet. For this purpose, either the substance itself or its opposite face must project slightly. If, however, the cork should at any time become too much worn, or otherwise give way, then the metal face of the valve would come into contact with the metal surface of the seating H, and again shut off the gas.

Guide-Carriages for Gasholders.—Cutler, S., of Millwall. No. 18,417; Sept. 28, 1894.

The patentee states that the object of this invention is "to provide a bottom guide-carriage for gasholders, which can be readily adjusted while the gasholder is in work, and which does not require packings or wedges to maintain its position after adjustment."



A substantial base-plate A is attached to the bottom curb B of the holder; and projecting from this base are two long bearings or sleeves C, in which are eye-rods D, the eyes of which form bearings for the axle E of a roller F, and the reverse ends of which enter the sleeves, and are fitted with screw-nuts G. The base-plate is first bolted to the bottom curb of the holder, and afterwards the roller is exactly adjusted, by means of the screw-nuts, and maintained in position by the nuts which abut upon the faced end of the sleeve.

Condensing and Washing Gas.—Kirkham, Hulett, and Chandler, Limited; a communication from F. D. Marshall, of Copenhagen. No. 18,441; Sept. 28, 1894.

This improvement in battery condensers is shown in the accompanying engravings—fig. 1 being a plan of the apparatus; figs. 2 and 3, sectional elevations at right angles to each other; and fig. 4, a sectional plan.

Fig. 1.

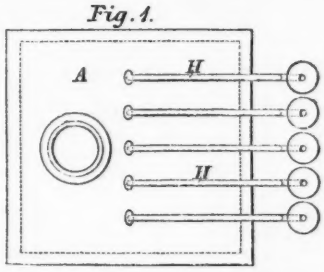


Fig. 2.

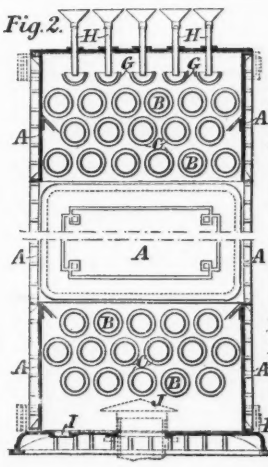


Fig. 3.

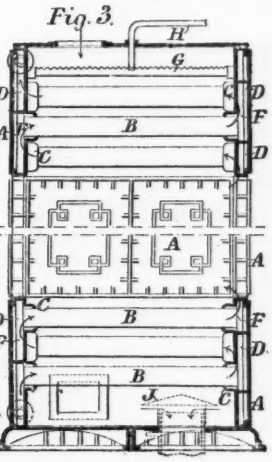
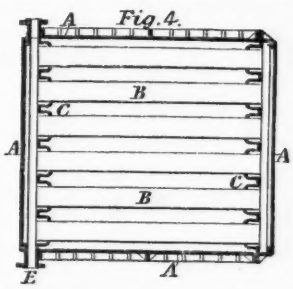


Fig. 4.



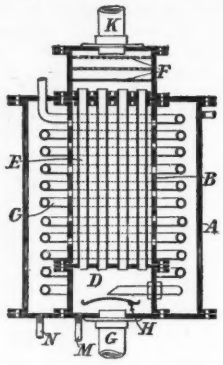
The walls of the apparatus A, for convenience of construction, are made in sections. B are the cooling pipes, carried at their ends in sockets C, formed on two opposite walls of the apparatus, and communicating with chambers D, formed in the walls, so that a cooling medium will circulate from an inlet E in the direction of the arrows F. All these parts being arranged in the usual manner, require no further description. G are a series of troughs arranged over the cooling pipes B, and adapted to be supplied with water through tubes H, provided with funnels. The troughs are notched at their edges, so as to divide the water which overflows from them into fine streams, and thereby cause it to be distributed over the cooling pipes B. The water which overflows from the troughs trickles down over the pipes, so that tar and other impurities condensed from the gas on the pipes may be washed off, and carried to the bottom of the apparatus, whence they escape through an opening I—the gas passing off through an opening covered by a cowl J.

As the water flows in at the bottom of the apparatus and escapes at the top, the hottest gas first comes in contact with the warmest of the cooling pipes, and leaves the apparatus after having passed over the coolest of the pipes.

Enriching Gas.—Kemp, W., of Kingston-on-Thames. No. 18,510 Sept. 29, 1894.

In constructing a gas enricher according to this invention, a casing A (which may be in the form of a vertical cylinder) is divided by an annular partition B into two compartments—a central compartment and an annular compartment surrounding it. In this latter compartment is a pipe-coil C, through which liquid hydrocarbon is passed, while the compartment is kept charged with steam. The hydrocarbon thus converted into vapour issues from the coil into a chamber D (at the bottom of the central compartment), into which gas is admitted by a pipe G, against a deflector H, and mingles with the vapour. The mixed gas and hydrocarbon vapour ascend a number of tubes E exposed to the heat of steam admitted through holes in the partition B to the space around the tubes. The mixture of gas, thus heated with the vapour,

after flowing through the tubes, passes through wire-gauze or perforated metal screens F, "thus becoming thoroughly mingled;" and the mixture issues at K. The supply of hydrocarbon is regulated by a valve:



and should there be excess, such of the liquid as is not vaporized is caught by the screens, and returns to the chamber below, whence it can be run off by a pipe M. The condensed steam passes away by the pipe N.

Coin-Freed Apparatus for the Sale of Gas in Fixed Quantities.—Glover, R. T. and J. G., of St. John's Street, Clerkenwell, E.C. No. 22,830; Nov. 24, 1894.

The object of this invention is: "First, to open a valve or faucet of a meter, to admit of a supply of gas to a consumer's pipes proportionate to the amount of rotative movement imparted to a screw by an inspector or other authorized person after the receipt from the consumer of an equivalent value, or . . . the necessary rotative movement may be imparted to the screw by the consumer turning a handle after the insertion of a given coin. Second, to close the valve or faucet, and stop the supply of gas, after the amount of gas prepaid has been supplied to the consumer, by the rotation of a second screw operated by the ordinary mechanism."

Fig. 1.

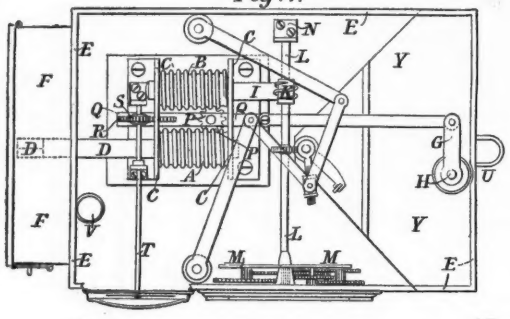


Fig. 2.

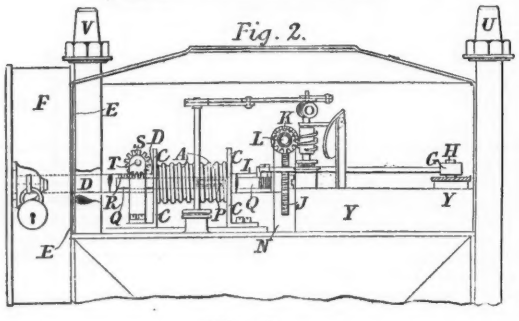


Fig. 3.

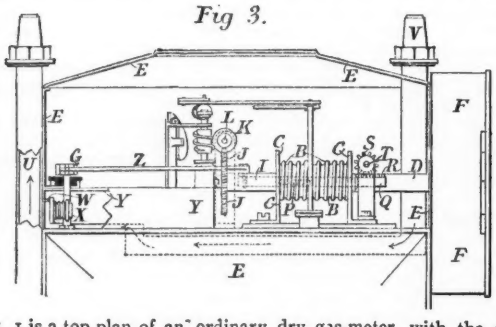
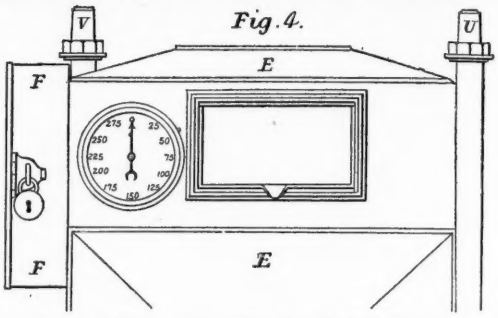


Fig. 1 is a top plan of an ordinary dry gas-meter, with the cover removed. Fig. 2 is a part sectional front elevation. Fig. 3 is a part sectional back elevation. Fig. 4 is an exterior front elevation of part of the meter.

Two screws A B are mounted between frames C, and have reduced ends or spindles D I that revolve in bearings formed by the frames C. The end of the spindle D projects through the meter-casing E into a box F, to which a hinged door is secured. The end of the spindle I, projecting from the screw B, is fitted with a worm-wheel J, that gears with a worm K fixed to a spindle L, one end of which is supported by the usual registering mechanism frame M, the other end by a pillar or bracket N. Each screw A B is in gear with a pinion P, on opposite sides, for imparting a rectilinear motion to the bar Q, to which the pinion is pivoted when either of the screws is rotated. A rack R is cut upon, or attached to, one end of the sliding-bar for gearing into a pinion S, secured to a spindle T, rotating in supports. Upon the end of the spindle T is a small index-finger that, moving over the indices of a dial, shows to the consumer the amount of gas prepaid or remaining unconsumed. The valve X is preferably enclosed within the usual bellows-valve chamber Y, and is operated by a link connected to the end of the sliding-bar Q and the crank G fixed to the end of the vertical spindle H projecting from the stuffing-box of the chamber Y.

Fig. 4.



The action is as follows: Assuming that the invention is not used in connection with coin-freed mechanism, but that a consumer wishing to obtain a supply of gas has paid for the delivery of a given quantity, the gas company's representative would open the box F, and (by means of a key or handle) turn the spindle D and screw A, which, by gearing into the pinion P, causes it to turn upon its pivot and move over the teeth of the other screw B, as upon a rack. This would cause the bar Q to slide longitudinally in its bearings a distance proportionate to the number of times the screw is rotated by the official, who would continue the rotation until the index-finger moved to the numeral representing the quantity of gas in cubic feet for which he has been paid. The longitudinal movement before mentioned of the bar Q, by the intermediation of the link and spindle H to which the valve X is connected, removes the valve from the orifice or seating W, and allows the gas to enter the consumer's pipe from the outlet U. When being consumed, the gas enters the meter by the inlet V, and operates the bellows and usual radial link-gear in the ordinary manner; but it also rotates the screw B, by means of the worm K gearing into the wheel J fixed to the end of the spindle I. This rotation of B, consequent upon the passage of gas through the meter, turns the pinion P upon its pivot in the reverse direction, and moving over the teeth of the first screw A as upon a rack, it causes the bar Q to return and move the index-finger to zero, and the valve X to close and stop the supply.

APPLICATIONS FOR LETTERS PATENT.

15,559.—Lang, J., "Device or meter for indicating the quantity of liquid passing through a tap, pipe, or the like." Aug. 19.

15,617.—Hall, C. F. N., and James, T. W., "Device to prevent the explosion or the igniting of the gas inside gas-burners, such as are known by the name of Bunsen burners." Aug. 20.

15,629.—Middlebrook, C., "Apparatus for receiving coin and supplying gas in exchange." Aug. 20.

15,659.—The Economical Gas Apparatus Construction Company, Ltd., and Merrifield, L. L., "Manufacture of carburetted water gas." Aug. 20.

15,780.—Challender, J., "Illuminating clocks, lamps, and signs, &c." Aug. 22.

15,795.—Walther, R., "Incandescence filaments and other similar bodies for use in incandescence gas or vapour lamps." Aug. 22.

15,857.—Edge, K., "Motor for use with air, gas, steam, or liquids under pressure." Aug. 23.

15,890.—Rohrbeck, E., "Gasifying and increasing the heating power of the gases of easily inflammable liquids." Aug. 23.

15,974.—Picken, W. B., "Governor gas-burner." Aug. 24.

Adoption of the Sale of Gas Act in Kent.—At a meeting of the Kent County Council last Wednesday, the Weights and Measures Committee reported that they had received many complaints that there are no inspectors in the county authorized, under the Sale of Gas Act, 1859, to examine and test gas-meters. Being of opinion that both buyers and sellers of gas ought to be protected against meters which register incorrectly, the Committee recommended the Council to resolve that the Administrative County should be brought under the operations of the Act, and that the Inspectors of Weights and Measures should be appointed to carry out the duties. The recommendation was adopted; and the Committee were directed to report as to the apparatus required.

Bradford Corporation Water Supply.—The Bradford Corporation are incurring considerable expense in connection with their water undertaking. They have had to bear the cost of the litigation with Mr. Pickles, as lately mentioned in the Journal; and now a claim for £30,000 is put forward by Mr. T. E. Yorke for an easement, seven or eight miles in length, for the new pipe-line from the Nidd Valley reservoir, through his estates at Stonebeck and Appletreewick. This matter has been submitted to arbitration; and Mr. Oakley has been appointed Umpire. It is reported that the contents of the Chellow Dean reservoir—some 30 million gallons—have had to be run to waste owing to the discovery of decomposed human remains therein. The value of this water is put at £1200.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Comparative Cost of Electricity and Hydraulic Power.

SIR,—I have only to-day seen Mr. Denny Lane's letter in your issue of Aug. 20, in which he calls attention to what he supposes to be a mistake in the figures taken from my paper read at the recent meeting of the Institution of Mechanical Engineers at Glasgow.

A Board of Trade unit of electricity is 1000 watts flowing for one hour. One horse power=746 watts; so that a Board of Trade unit of electricity=1⅓-horse power. 2·76d. per unit=2·07d. per horse-power-hour. 3d. per brake-horse-power-hour is correct on the assumption that the efficiency of the hydraulic motor is 69 per cent. If the efficiency is taken at 75 per cent., the cost per brake-horse-power-hour would be the same as the cost of the unit of electricity.

Mr. Lane has confused the brake horse power with the energy of the electric current.

E. B. ELLINGTON.

Palace Chambers, Westminster,
Aug. 28, 1895.

Illuminating Gas for Heating Purposes.

SIR,—Mr. Frederick Siemens, in his paper on this subject (*ante*, p. 439) made many statements which will not bear examination, and which unfortunately are made at the expense of other manufacturers' reputations. A few of the statements are appended in the order given, and also the actual facts, which are easily verified.

"A heating apparatus must be cheap." The price of a Siemens stove, in common sheet iron, is £7 10s. How long this stove will last, without rusting through, many of your readers will know. Referring to cast-iron stoves, he states: "The heated iron permits the poisonous gases of combustion, for instance, *carbonic acid*, to pass through it." It is well known, even to young beginners in chemistry and hygiene, that carbonic acid is *not* poisonous, and is as inert as nitrogen, which is the largest constituent of ordinary air. He states: "I classify under the head of 'common stoves' all stoves of which the external surface is heated to over 212 degrees." This is, as stated by Mr. Siemens, to prevent the charring of organic matter floating in the air; and very strong language is indulged in. He may safely classify his own stove along with these, as it readily chars paper or any organic matter placed on any of the heating surfaces.

Mr. Siemens makes the usual statement that "a regenerative gas-flame radiates at least twice the heat of a common gas-flame." This is a tale which has become almost historical by reiteration. That a regenerator *lamp* radiates much heat, is true. That the *flame* does this, has yet to be proved; and certain facts point to the contrary. I do not wish to advertise any maker; but I have in my possession some reflector stoves (which are not regenerators) which burn the same quantity of gas for the size and width as the Siemens, and which give a far greater percentage of radiant heat. These may be tested by an expert for comparative duty as regards radiant heat. The fact is that the gas consumption in the Siemens stove—*i.e.*, 3 cubic feet for every 1 inch length of burner = 24 cubic feet per hour in an 8-inch burner—is enormously in excess of that which has been considered in this country desirable for stoves of this class; and, given a gas consumption as large as that in the Siemens stove, there is no difficulty in making good reflector stoves without regenerator, which, for radiant heat, will compete successfully with any incandescent fire.

Those who have had experience with regenerator burners will be able to judge of the permanence (or otherwise) of a regenerator made of sheet iron.

THOS. FLETCHER.

Warrington, Aug. 31, 1895.

LEGAL INTELLIGENCE.

A Water-Rate Question at Kingsand.

At the Torpoint Petty Sessions last Wednesday, ten persons were summoned by the St. Germans District Council for the non-payment of water-rates due. The first case taken was that of Mr. P. M. Phillips, of Kingsand; the amount claimed being 1s. 10½d. Mr. F. Cleverton, who represented the Council, mentioned that some time since £7000 was borrowed for the purpose of providing Millbrook and the district with a water supply; and a scale of charges was drawn up. Mr. Clark, a turncock, admitted that for the past three months there had been only one available stand-pipe in Kingsand from which the inhabitants could obtain any water; all the other taps being dry. Mr. Harris, the Manager of the Torpoint Water-Works, stated that he regarded the charges as very reasonable. Mr. Martyn, for the defence, before dealing with the question of supply, submitted that the only way in which the Council could make a rate was under section 56 of the Public Health Act, which specified that the rate must be made on the net annual value of the premises. In the case in point, it was on a sliding-scale, and the defendant would have to pay on a rateable value of £6; whereas the sum under the Act was £4 10s. He said that section 62, upon which Mr. Cleverton relied, only applied to cases where the inspector reported that it was necessary to lay on a water supply. The Magistrates upheld the objection, and dismissed the summons. Mr. Cleverton was granted leave to appeal; and the other nine summonses were accordingly adjourned for a month.

A New Reservoir for Holyhead.—In consequence of the recent scarcity of water and the growing needs of the town and neighbourhood, the Holyhead Water Company have decided to construct a new reservoir. It will be the third open reservoir, and will cover an area of 2½ acres. The cost, including the site, will be £5000.

MISCELLANEOUS NEWS.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The revenue of the Abingdon Gas Company for the six months ending June 30 was £2200; and the expenditure, £1613—leaving £587 to be carried to the profit and loss account. The amount available for distribution is £825; and, at the meeting of shareholders next Thursday, the Directors will recommend dividends at the rate of 6s. 3d. per share on the original shares, and of 4s. 4½d. per share on the "B" shares, which will absorb (after deducting income-tax) £428, and leave £397 to be carried forward.

The shareholders of the Cork Gas Consumers' Company had their 53rd ordinary general meeting on the 21st ult., when the Directors stated in their report (which was signed by Mr. Denny Lane, the Secretary) that notwithstanding the reduction in the price of gas, amounting to upwards of £1200, which has been in operation since December last, the rental in the six months ending June 30 showed a satisfactory return. This arose partly from the fact that very cold and dark weather prevailed in the quarter ending March. In consequence of having accumulated a large stock of coke, the Directors were induced to lower the price of that article throughout the half year; and this led to a diminution in the receipts from residuals. Sulphate of ammonia realized a fair price; but the Directors did not regard the prospects as favourable. The Company's Engineer (Mr. G. Anderson) reported that the works had been kept in efficient order, and were more than adequate to meet all demands. Since the introduction of the system of gaseous firing in the old works, much more gas is made there than formerly; and this has caused a deficiency in condensing plant. The Manager (Mr. T. Travers) is now enlarging this by bringing into action some vessels which have been out of use since the employment of wet lime in purification was discontinued. This has Mr. Anderson's entire approval. Generally, the capacity of the works is ample for the next two years. The accounts accompanying the report showed that the revenue in the six months covered by it amounted to £26,141; the expenditure, to £18,827—leaving £7314 to go to the profit and loss account, which with the balance of £5708 brought forward made a total of £13,022. A sum of £600 was added to the depreciation fund; and the payment of interest, &c., brought the balance down to £5428. As the dividend would absorb £5652, it was necessary to take £224 from the reserve, which would then stand at £14,296.

In moving the adoption of the report at the half-yearly meeting of the Derby Gas Company last Wednesday, the Chairman (Mr. H. Swingler) described the railway race to Aberdeen as similar to the contest at Derby between gas and electricity. Fortunately, they could now see the actual result of the contest in Derby; and contrary to the opinion of some, it was not detrimental to gas. The first complete comparison between the two illuminants had been made; and he was delighted to be able to tell the shareholders that the increase in the consumption of gas during the six months ended June 30 had amounted to 13,031,000 cubic feet over the corresponding half of last year. Against this there was a slight drawback, as the item for public lighting showed a decrease of 1,285,000 cubic feet. The gross revenue for the half year had been less by £11,073; and the expenses had been £750 more. This might sound inconsistent, but he had a good explanation to offer. There had been a reduction of 3d. per 1000 cubic feet in the price, which had made a difference in the revenue of about £1800. Besides this, there had been low prices obtained for residuals, with the exception of tar, which showed a slight increase. The principal item of decrease was in sulphate; and altogether they had lost £985 on the residuals. There was, nevertheless, an increase in the quantity of gas consumed by private customers, a great part of which had arisen through the introduction of gas-stoves, of which they had 619, against 300 at this time last year. After paying the statutory dividends of 10, 7, and 5 per cent., they were enabled to place a comfortable sum to the reserve fund; and he felt the Company had nothing to fear from competition.

The ordinary meeting of the Douglas Gas Company was held yesterday week. The Directors reported that the net profit for the past half year was £3272 in advance of the corresponding period of 1894. The Directors also stated that, in consequence of an exceptionally favourable coal contract, they would be able shortly to reduce the price of gas 2d. per 1000 cubic feet. A dividend of 30s. per £25 share was declared; being an increase of 2s. 6d. per share.

At the half-yearly meeting of the Eastbourne Gas Company yesterday week, the Directors submitted a report showing a profit of £6111, which, added to £9671 brought forward and £225 received for interest, gave £16,007 available for dividend. The Directors recommended that a dividend for the past half year be declared at the rate of 14 per cent. per annum on the £20,000 original capital and also on £12,490 (the amount raised on "C" shares), and at the rate of 11 per cent. upon the £65,000 paid-up capital raised on "B" shares, which will absorb £5849, and leave £10,158 to be carried forward. The Directors also referred to the loss to the Company of Mr. G. Lenny, who was for many years a Director. In addressing the shareholders, the Chairman (Dr. G. A. Jeffery) made the satisfactory statement that the sale of gas had increased from 97,716,000 cubic feet in six months last year to 107,724,000 cubic feet this half year—a gain of 10,008,000 feet. The leakage was 2,504,000 cubic feet, or only 2 per cent., as against 2·84 per cent. This was extremely low; but it was borne out by the returns of 1892, 1893, and 1894. With respect to the residuals, they had not fetched so much in the market. The make of tar had been 10 gallons per ton. Sulphate of ammonia had increased to 21·4 lbs., as against 20·7 lbs. last year. On the other hand, the sale was very much less than it was in the previous half year. He supposed this was owing to the agricultural distress; farmers not being able to use so much for manure, as they could not pay for it. Of coke the yield was 9·5 sacks, as against 9·1 sacks; and the fuel account had been 20·6 per cent., as against 23 per cent. The motion was unanimously carried. Resolutions were afterwards passed, voting £105 towards the cost of the erection of a statue in Eastbourne to the memory of the late Duke of Devonshire; and electing Mr. C. Diplock to the vacant position on the Board. The thanks of the shareholders

were also tendered to the Chairman and Directors, and to the Consulting Engineer (Mr. H. E. Jones), the Manager (Mr. J. Hammond), and the Secretary (Mr. J. H. Campion Coles).

The Falmouth Gas Company will hold their fifth annual meeting next Thursday, when the Directors will report continued steady progress in the Company's business. Improvements in burners and the introduction of prepayment meters have tended to further popularize the use of gas. Up to June, 1894, there had been fixed 53 of these meters; but by the close of last June they numbered 131, and a consumption of nearly a million cubic feet of gas was registered by them during the year. With the view of showing the advantage of the incandescent system for public lighting, the Directors have put up seven burners in Market Street; and they express the hope that the Corporation will be induced to adopt the new light throughout the borough. The works and plant (under the supervision of Mr. J. W. Buckley) have been maintained in good order, and some improvements made; the chief of which has been the raising of the coal-store roof, to facilitate the stacking of coal in the outer portion of the store. It is proposed to pay a dividend at the rate of 12 per cent. per annum for the past half year—making 11 per cent. for the year; to transfer £135 to the reserve fund; and to carry forward the balance.

It was reported at the annual meeting of the Hartlepool Gas and Water Company last Thursday that the quantity of gas supplied during the year was 297 million cubic feet, which was an increase of 5 per cent. over the previous year. The gross revenue was £62,297, an increase of £1070; and the expenditure was £34,862. The Directors had lowered the price of gas by 1d. per 1000 cubic feet. The water supply had been 36 million gallons for manufacturing purposes, and for domestic use 646 million gallons. The Company suffered much from the severe frost of January and February; but not so seriously, the Directors thought, as some other towns. Dividends were declared of 8½ per cent. on the "A" shares, 7½ per cent. on the "B" shares, and 7 per cent. on the "C" and "D" shares, all clear of income-tax.

At the half-yearly general meeting of the Hastings and St. Leonards Gas Company next Thursday, the Directors will report a continued increase in the demand for gas. In the six months ending June 30, there was a rise to the extent of upwards of 9½ million cubic feet, or at the rate of 6 per cent., over the corresponding period of 1894. The Directors propose making a further reduction of 2d. per 1000 cubic feet in the price of gas as from Jan. 1 next; bringing it to the uniform figure of 3s. per 1000 cubic feet. It is satisfactory to find that the supply of gas by the prepayment system has been very successful; and the demand for automatic meters is increasing. The Directors point out that the development of incandescent gas lighting has placed in the hands of consumers a convenient, brilliant, economical, and hygienic light, which, when properly installed, is, they say, superior to any other system of artificial illumination. Experiments and investigations have been conducted for some time past by the Company's Engineer (Mr. C. E. Botley, Assoc.M.Inst.C.E.), with the view of minimizing the difficulties caused by naphthalene deposits, and the consequent troubles and annoyances; and it has been arranged to put the results obtained to a practical test at as early a date as possible. The financial statements accompanying the report show that a sum of £1777 was expended in the past half year on capital account, mostly on new mains, services, &c.; but upwards of £640 of it was for new meters and stoves. They also show a profit balance of £12,337; and the Directors propose to pay a dividend at the rate of 12½ per cent. per annum on the £25 shares, and of 9½ per cent. per annum on the £20 shares—carrying forward the balance. The quantity of coal carbonized or used was 17,196 tons 8 cwt. of Newcastle, &c., and 231 tons 4 cwt. of cannel; the gas production being 177,674,000, of which 172,887,300 cubic feet were accounted for. The estimated production of residuals was: Coke, 10,740 tons; breeze, 878 tons; tar, 176,247 gallons; and ammoniacal liquor, 350,883 gallons.

In the report to be submitted by the Directors to the shareholders of the Keswick Gas Company at the eighth ordinary general meeting to-day, they state that there is a balance of £1113 on the working for the year ending June 30, which with a sum of £647 brought from the last account, makes the sum of £1760. Deducting from this amount £8 for interest on loan, there remains £1752, from which the Directors propose to set aside £110 to the depreciation fund, and £194 to a mortgage redemption account; leaving £1448 available for distribution. They recommend a dividend at the rate of 8½ per cent. per annum on the original capital, and of £5 19s. per cent. per annum on the additional capital. This will absorb £834, and leave £614 to be carried forward. In order to increase the storage at the works, the Directors have entered into a contract with the Whessoe Foundry Company, Limited, of Darlington, for the erection of an additional gas-holder, which is now being constructed.

The half-yearly accounts of the Milnrow Gas Company disclose a disposable balance of £646, out of which it is proposed to pay a dividend at the rate of 8 per cent. per annum, free of income-tax. The sale of gas realized £1782; and the residual products, £274. The total expenditure was £1373.

Notwithstanding the depressed season at Morecambe, the consumption of gas in the year ending June 30 was slightly greater than in the preceding twelve months; and there was an increase in the number of consumers. The reduction in the price of gas, which came into operation in October, lessened the amount received from its sale; and the low prices of sulphate of ammonia reduced the receipts from this product. On the other hand, the increased income from the general sales of residuals, and a decrease in the cost of coal and in expenditure on repairs, enabled the Directors to submit a satisfactory balance-sheet at the meeting of shareholders last Friday. The profit on the year's working, after payment of interest on the preference stock and mortgages, amounted to £2198; and this added to the balance of £108 brought forward made a total of £2306 available for distribution. Out of this, an interim dividend of 5 per cent. was paid in March, amounting to £1000; and the Directors recommended a further dividend of like amount, free of income-tax—leaving £306 to be carried forward. Under the supervision of the Manager and Secretary (Mr. W. Duff), 3344 tons 2 cwt. of coal were carbonized or used during the year; the estimated production of residuals being: Coke, 2090 tons; tar, 50,800 gallons; sulphate and ammoniacal liquor, 33 tons 1 cwt.

The shareholders of the Normanton Gas Company have held their half-yearly meeting. The Chairman (Mr. W. Statter) was absent; and his place was occupied by Mr. E. Mitchell. In his remarks, he stated that the Company was formed 26 years ago, and had never until now paid a dividend of 10 per cent. For some time after its formation, they had no dividend; and then they began with 2½ per cent. Many companies who had charged a higher price for gas from the commencement had paid 10 per cent. long before this Company were able to do so. Although the Directors did not raise the price during the coal strike, they had now decided to reduce the charge for the gas taken by the Normanton and Altofts District Councils by 4d. per 1000 cubic feet from Oct. 1; and they hoped to be able to reduce the price to ordinary consumers. Reviewing the accounts, the Chairman said the increase in the make of gas was 1,170,000 cubic feet compared with the first half of 1894. Rates and taxes had advanced from £108 to £163. They had had much trouble with the rating authorities since they constructed the new gasholder; but after an interview with the Assessment Committee and the valuer, they obtained a substantial reduction in the original assessment, though not what they thought they should have had. The total expenditure on revenue account was £1460. From the sale of gas they received £1936; from coke, £312; from ammoniacal liquor, £64; and the stock was valued at £158. The net profit was £1016; and it required £1000 to pay the 10 per cent. dividend. The report was adopted.

At the half-yearly meeting of the Rochester, Chatham, and Strood Gas Company last Thursday week, the Directors reported that satisfactory progress had been made during the six months ending June 30. The demand for gas continued to steadily increase; and the use of the incandescent gas-light was extending. The new station at the Gillingham works is now in working order. The Directors have thought it advisable to raise the washing and scrubbing power at both works The statement of accounts showed a total income of £26,313, with a net profit of £3018. It was decided to declare a dividend at the rate of 10 per cent. per annum on the "A" and "D" shares, and of 7 per cent. on the "B" and "C" shares.

The Sunderland Gas Company report a continued increase in the consumption of gas; the quantity manufactured during the past twelvemonth being 30,422,000 cubic feet in excess of the previous year. The total revenue was £83,995; and the expenditure, £66,989—showing a profit of about £17,000. An interim dividend was paid in March last; and the Directors recommend a like dividend of 5 per cent. on the original stock, and 4½ per cent. on the additional capital stock. It is proposed to sell by auction 1000 £5 shares at the close of the annual meeting next Thursday.

The half-yearly meeting of the Sutton Gas Company was held on Monday last week. Mr. C. R. Mead presided. The report stated that the severe frost of January and February caused an unprecedented demand for gas, which was duly met by an exceptionally large production at the works. An extension of the exhausting and purifying plant was being effected this year to meet the growing consumption of gas. The Directors had decided to further reduce the price 2d. per 1000 cubic feet; making the general price 3s. 4d., less 6d. per 1000 feet discount, or a net price of 2s. 10d. To large consumers the price would be 2s. 8d. for all gas consumed beyond the first 100,000 cubic feet per annum. The profit for the half year amounted to £1980; and dividends at the rate of 10 and 7 per cent. per annum on the original and the additional capital were declared.

The Warminster Gas Company have earned a profit on the past year's working of £715, out of which a dividend at the rate of 6 per cent. has been declared. The 2d. added to the price of gas during the coal strike is to be taken off from Sept. 29; and this will make the charge 3s. 6d. per 1000 cubic feet.

The revenue of the Wellingborough Gas Company, Limited, for the half year ending June 30 was £5653; and the expenditure, £3828—leaving £1825 to go to the profit and loss account. As the consumption of gas has increased, and the Directors have been able to make rather more favourable contracts for coal, they purpose reducing the price of gas 2d. per 1000 cubic feet as from the 29th inst. At the half-yearly meeting on Monday last week, dividends of 5½ and 4 per cent. for the half year were declared on the three classes of the Company's stock, free of income-tax.

The ordinary meeting of the Wolverhampton Gas Company was held last Tuesday, when it was reported that a profit of £8281 had been made in the half year ending June 30 last; and the Directors recommended dividends of 5 and 3 per cent. upon the various classes of stock. The Chairman (Mr. H. Ward) reminded the proprietors that the Directors had reduced the price of gas from 2s. 9d. to 2s. 6d. per 1000 cubic feet. The lower price came into operation last quarter, when the least gas of the whole year was consumed. There was reason, therefore, to believe that they had not yet experienced the full effects of the reduction. The price at which the residuals were sold had seriously declined; and the falling off last half year amounted to between £700 and £800. He complained of the rise in the rates and taxes; these charges having been increased in two years from £2221 to £2921. The gas-rental was large; and they had no reason to anticipate a reduction, nor had they cause to fear the competition of the electric light. The Directors were now asking for a further increase of capital. Twelve years ago they had £8500 to their favour at the bank; but now they had an overdraft amounting to £7088. It was not in the interests of the Company to allow this condition of things to continue; and it was therefore intended to raise additional share capital in order to cover the expenditure which had produced the change in the balance of their banking account. The motion having been passed, it was decided to create and issue £15,000 of new ordinary stock, to bear interest at 6 per cent. The Chairman explained that at the last sale of stock each £100 share realized £121. He said they had only power to raise £80,000, including premiums on the shares; and it was expected that £15,000 of stock would realize £18,000.

Water Companies.

At the half-yearly meeting of the East Warwickshire Water Company last Thursday, the Directors reported that the gross amount of water-rates was £1067, as compared with £997 in the corresponding period of 1894. The sources of water having proved insufficient, the

Directors have requested Professor Lapworth, of Birmingham, to report fully upon the water-bearing strata of the entire district. On the receipt of his report, they will be able to arrive at a conclusion as to whether or not the present works may be continued with advantage, or whether it would be advisable to erect works elsewhere, so as to secure an ample supply of water to meet the rapid increase of the town. The Chairman (Captain H. Townshend), comparing the expenditure of the half year, said there had been an enormous increase; but this was mainly due to the borings for water. Owing to its scarcity, the Company had not made more connections with houses than could possibly be helped. The work done at the wells had entirely failed to produce an increased supply of water; and the cost of boring and heading had been so considerable, that they had decided on stopping the works altogether. The time had arrived when the town would have to seriously consider what must be done to secure an ample service of water. The present wells would not yield an increased supply; and the Company were not prepared to commence new works, apart from their present ones. The report was adopted; but no dividend was declared.

The annual general meeting of the Lewes Water Company was held last Tuesday. The Directors reported that the receipts in the year ending June 24 amounted to £3331; and the expenditure, to £1295—leaving a balance of £2036. The interim dividend paid in February took £1035; so that there was left for disposal the sum of £1001. The Directors recommended dividends of 5, 3½, and 2½ per cent. on the various stocks for the half year (being 10, 7, and 5 per cent. for the year). These would require £1035; and therefore £34 had to be taken from the reserve fund. In moving the adoption of the report, the Chairman (Mr. F. Verrall) expressed regret at the loss the Company had sustained by the death of Mr. Lenny, who had been connected with the Company since 1865, and had occupied the chair for a great many years. Mr. Broad, in supporting the motion, said the proprietors would notice that the expenditure had been rather heavier than in the preceding year; but when they considered the frost of the past winter, it was not to be wondered at. They experienced great difficulty, and the Manager (Mr. A. Wells) was at his wits' end to keep pace with the leaks. After the frost they had a dry season, and the quantity of water sent out was immense. During the year, they had connected 29 old houses and 9 new ones, making 38 new customers. The estimated bulk of water pumped during the year was 119,897,000 gallons, as compared with 113,205,000 gallons in the preceding year; being an increase of 6,692,000 gallons. The report was adopted, and the dividends recommended were declared.

At the half-yearly general meeting of the Maidstone Water Company on the 22nd ult., the Directors reported that the water-rents amounted to £4701, and that there was a profit of £1890 available for division. They recommended the payment of a dividend, free of income-tax, for the six months, of £4 0s. 10d. per cent. on the 10 per cent. shares, and of £2 16s. 8d. per cent. on the 7 per cent. shares. These payments would absorb £1811. The dividends were respectively £4 12s. 6d. and £3 5s. in the corresponding half of 1894. The Chairman, in moving the adoption of the report, said he should like to have been in a position to tell the proprietors that the dividend was a little better, instead of a little worse, than it had been; but he saw no reason for any suggestion that things were not going on satisfactorily. They must remember that they had had a very trying half year. In the first portion of it, they had extremely severe frost for a very lengthened period; and at the latter part, they had a scorching drought. In the one case, damage to a considerable extent was done to the mains and pipes of the Company; and in the other, extra expense was incurred in pumping water to meet the large demand. Further, during the severe frost, the consumption of water fell short in consequence of meters being frozen in many cases for a long time; and in each instance consumers were unable to get water through them. Therefore, the Company had suffered in three different ways during the half year; and the fact that the dividend was not quite so much as usual was clearly accounted for. He was in a position to say that the works of the Company were in an exceedingly good state of repair; this being due to the earnestness, ability, and energy of their Engineer and Manager (Mr. W. Ware). The report was adopted; and the dividends recommended were declared.

At the half-yearly meeting of the South Staffordshire Water Company last Thursday (Mr. Frank James in the chair), the Directors' report, noticed in the JOURNAL on the 13th ult., was presented. In moving its adoption, the Chairman remarked that it covered the period of the great frost of the past winter, which, for severity and length had not been equalled within the memory of any of them. Its effect upon the Company was shown in the balance-sheet. It had absorbed a large amount of money, which fortunately they had in hand; and it would now be their duty to build up a balance such as they had before. They had always carried forward a large sum for contingencies; and this course had stood them in good stead during the late frost. It was sometimes said that water companies might provide against such contingencies by laying the mains, &c., deeper; and their works had been criticized. Their pipes had been laid to the best advantage. They had had to relay nine miles of mains that were burst through the frost; and considering that the length of a section was only about 9 feet, this represented more than 5000 mains which had been fractured. Engineering charges had been increased by £300, in consequence of a larger quantity of water than usual having been pumped. Something like 293 million gallons were pumped during the half year in excess of the corresponding period. An enormous quantity necessarily ran to waste through consumers leaving their taps running, or through the breakage of the pipes. The largest item was for maintenance of works, which was £6813, compared with £2547 in the corresponding period of last year. The sum included the cost of relaying the nine miles of mains and the cost of the pipes. The ever-increasing item which represented rates was £3744—£350 more than in the corresponding half year. On the other side, the water-rates received had advanced from £41,378 to £42,551. They brought down a balance of £15,956; and the dividend paid on the entire stock of the Company amounted to £15,817—leaving only £139 to be carried forward, as compared with £4779 in the corresponding period. The Directors had thought it wise not to decrease the dividend, as they looked upon the circumstances with which they had had to deal as purely exceptional. Mr. Townshend seconded the motion, which was agreed to. Formal resolutions were also passed declaring the dividends recommended. An extraordinary meeting was then held to authorize the issue of £30,000 of stock, the unissued portion of £50,000 of new stock created by resolution in August, 1893; and to raise a further sum of £50,000 of the new stock sanctioned by Parliament in that year. The Directors' proposals were agreed to.

The revenue of the Woking Water Company during the half year ending June 30 last amounted to £3109, and the expenditure to £1280. The outlay incurred through the late frost was £330; and one-third of this amount has been charged to the past half year—making the total expenses £1390. The balance carried to profit and loss account is £1719; and the sum available for division is £1527. An interim dividend at the rate of 4 per cent. per annum for the half year was declared at the meeting of the shareholders last Tuesday. This will absorb £1471, and leave £56 to be carried forward. The total expenditure on capital account to June 30 has been £79,978. The Directors in their report expressed deep regret at the death of their colleague Mr. Walter G. Gribbon, whose services were of great value to the Company. The vacancy has been filled by the election of Mr. W. Edmonds, J.P., who for many years has been Auditor to the Company.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the Offices, Katharine Street, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. J. Russell) having read the notice convening the meeting,

The CHAIRMAN moved the adoption of the report and accounts. In doing so, he first referred to the sale of gas, which had amounted in the half year to 283,754,300 cubic feet. In the corresponding period of last year, it was in the Croydon district 236,951,500 cubic feet, and in the Carshalton district 14,893,200 cubic feet, or a total of 251,844,700 cubic feet. This gave them an increase of 31,909,600 cubic feet, or an unprecedented advance of 12·67 per cent. This, of course, was an abnormal rise, and one easily accounted for by the Arctic weather experienced in January and February last. Having explained that such high rates of increase consequent upon severe weather were not always a great benefit to gas companies, he turned to the residual products, which, he said, on the whole, had not been so satisfactory as the Directors could have wished. For instance, although an additional 5987 tons of coal had been carbonized, only £9660 had been realized for coke, which was £858 less than in the corresponding period of last year—the loss being equal to 1¼d. per cwt. Fortunately, another residual had come to their rescue. They had sold a much larger quantity of tar, and had realized ¼d. per gallon more for it, which, in round figures, represented £1203, which more than wiped out the balance against them on coke. They had made a considerably larger quantity of sulphate of ammonia, which, however, showed a drop of something like £2 15s. per ton; and at present there was no prospect of improvement in the price. Although they had sold more sulphate, they had received £138 less for it. Regarding prepayment meters, 123 more cottages had been fitted up under this system; making the total number 1005. Additional cooking and heating stoves had been supplied; making the total now on hire 2837. In the report reference was made to the revaluation of the Company's property for local taxation. A re-assessment was ordered by the Assessment Committee of the Croydon Union; and they assessed the Company's property at a sum which the Directors considered most unreasonable. They tried their very utmost to meet the Committee fairly in the matter, and even went beyond what they thought they were justified in doing, in order, if possible, to prevent litigation. The Committee, however, would not meet them. The Company were very much indebted to their friend, Mr. Corbet Woodall, who, happily for them at the present time, was one of their Directors. He had spent a great deal of his time in going into this matter, with the object of meeting the Assessment Committee to the extent he thought was right—in fact, rather more than he thought was right. As the proprietors knew, they had two days' fighting, when unfortunately, at the request of one of the Counsel (who, the Directors thought, had an object in view in wishing to postpone it), the case was adjourned until Nov. 1, when the Directors hoped to get a reduction to considerably below what they offered as a mediation in the matter. The next matter to which he had to refer would, he believed, be pleasing to the consumers, and would, he trusted, meet with the approval of the proprietors. It was that the Directors had reduced from July 1 last the price of gas from 2s. 9d. to 2s. 8d. per 1000 cubic feet in the Croydon district, and from 3s. 6d. to 3s. 5d. in the Carshalton district, and had lowered the charges for meters from 1s. 3d. to 1s. per quarter. These reductions would give an immediate benefit to the consumers of £2800 per annum. Some of the proprietors might think it was time they had a further increase in dividend. But, of course, the Directors had to take all the circumstances into consideration; and they believed the course they had adopted was a wise one. The Directors proposed to place £1000 to the insurance fund, and to add £1755 to the reserve fund, which would make the total of the two funds upwards of £44,500. After paying the usual dividends, and transferring the two sums just referred to, there would be a balance of £4320 to be carried forward, or about sufficient to pay one-third of the next dividend. Turning to the accounts, he pointed out that the total capital expenditure to June 30 last was £316,776, which worked out to about £5 7s. per ton of coal carbonized, which was a low figure. The expenditure of capital during the half year amounted to £11,977. Nearly the whole of this was comprised of amounts that had been paid to Messrs. John Aird and Sons and Messrs. C. & W. Walker for the construction of the new tank and holder. Not only did he think so, but experts on gasholders had expressed the opinion that there was not a better holder in the kingdom. It was certainly light in appearance; and some of the proprietors might regard it as a flimsy-looking structure compared with their other holders. But it was not so, as in one case the columns were rolled

steel, and in the other of cast iron. This holder did their Engineer (Mr. J. W. Helps) infinite credit, because he designed it, and it had been carried out under his superintendence. It was intended to hold 3 million cubic feet of gas, or more than the whole of the three existing ones; so that for some time Mr. Helps, he believed, would be satisfied with his storage accommodation, and would not call upon them to spend another £33,000, which was the cost of this holder. The other items of capital outlay were: Mains, services, &c., £791; meters, £358; and stoves, £571. The balance of capital was only £1905. The receipts from sales of 283,754,300 cubic feet of gas in the six months amounted to £40,397. By an unfortunate mistake (which the Secretary wished him to explain), the quantity of gas used on the works was entered in the accounts as 1,169,400 cubic feet, instead of 3,661,200 feet—the error being due to a quarter's consumption having been taken instead of the half-year's. The total quantity of gas accounted for should therefore be 287,415,500 cubic feet, instead of 284,923,700 feet; and the amount unaccounted for 14,451,500 cubic feet, instead of 16,943,300 feet, which was equal to 4·77 per cent. on the quantity of gas made, which, for them, was rather a high percentage. He explained that some of the leakage was attributable to the condition o the Carshalton mains; but Mr. Helps was doing his best to eradicat the defective pipes as quickly as possible.

The DEPUTY-CHAIRMAN (Mr. A. J. Lambert) seconded the motion, which was unanimously carried.

The following dividends were next declared: At the rate of 14 per cent. per annum on £51,600 consolidated "A" stock; 11 per cent. on £157,500 "B" stock; and 9 per cent. on £25,000 "C" stock, and on 2500 ordinary £10 shares on which £2 have been paid (Carshalton capital).

Mr. CORBET WOODALL then moved a resolution to the effect that a sum of £1755 15s. be placed to the reserve fund. He remarked that they had not at present a reserve fund amounting to the 10 per cent. authorized under the Act of 1847, before the sliding-scale was introduced. As no doubt the proprietors were aware, they could now only add to this fund out of money that might be distributed as dividend. The proprietors were entitled to a larger dividend than was at present declared; and this £1755 represented the balance that might have been paid to them had they chosen to take it. It was hardly necessary to say that a reserve fund was better for the Company than an inflated dividend; the accumulation of such a fund being a security that the dividends would be maintained for at least some time to come. It was right that he should call attention to the fact that the £1755 had not been earned in the half year, nor even the £1000 which had been transferred to the insurance fund; for, after paying interest and dividends out of the half-year's profits, they had only a balance of about £800 towards the two amounts referred to, and the rest was taken from the undivided profits. It was extremely satisfactory to the Directors to find the proprietors were in accord with them in regard to the reserve fund, as he felt quite sure it was to the true interest of the Company. The reduction in price that had taken place, would more than wipe out the balance of the half-year's earnings; but they had sufficient faith in the future of the gas industry in Croydon not to be afraid to go a little beyond what the actual earnings of the past half year would seem to justify.

Mr. J. PELTON, J.P., seconded the motion, which was passed.

The CHAIRMAN moved a resolution authorizing the Directors to raise £20,900 of consolidated "B" stock. He explained that they received the sanction of the shareholders in August, 1892, to raise £30,900 by the issue of ordinary £10 shares; and of this they had raised £10,000. By their Act of 1894, they had obtained power to issue stock instead of shares; so that he was simply proposing this resolution to bring them into conformity with the new Act.

The motion was carried.

Alderman LAYTON proposed a vote of thanks to the Chairman and Directors, remarking that he hoped the new coal contracts would enable the Directors to arrive at a larger return than last half year.

Mr. MAGNUS OHREN seconded the motion, which was agreed to.

The CHAIRMAN, in responding, observed that the Directors had made satisfactory arrangements with regard to coal; and he thought they could see their way clear to present on the next occasion an equally good balance-sheet to the present one.

The services of the Secretary and Engineer and their respective staffs were also duly acknowledged.

The Early History of the Company.

At the conclusion of the ordinary business at the above meeting, Mr. W. HYSLOP, who, after having been a Director since the formation of the Company, resigned his seat last year, gave the proprietors a short account of the history of the concern. He said that gas-works were first established in the town some fifty years ago by a Mr. Defries. They were only on a small scale. Shortly after the works were purchased by Mr. Henry Overton, a brewer in the town. There was a great outcry as to the supply and the impurity of the gas, and more especially as to the price, which was 13s. per 1000 cubic feet. He himself was at that time a consumer. It was thought that something ought to be done; and he and one or two friends had several meetings to consider the question. These resulted in a Committee being formed; and those who constituted it called public meetings to discuss the object they had in view. Eventually it was resolved to negotiate with Mr. Overton with regard to the purchase of the works. He offered to receive £8000 for them; and, after a little consideration, this was agreed to. Then a Company was floated with a Board of eight Directors; but no sooner had they done this, than they were informed that an opposition Company was being started. The latter proceeded at a rapid rate; put in the foundations for their works; and went to considerable expense. They, however, saw danger ahead, and wished to meet the Directors of the first Company. A meeting was arranged; and, at the interview, they stated they would have no objection to withdraw the opposition if the Company would pay the expenses which they had incurred. They placed the amount at £1800, but accepted £1000. This Company then proceeded, under considerable difficulties, for ten years; the Directors acting without any fee or reward. The shareholders then granted the Directors £100 for division among them. There were at that time a great many complaints as to the impurity of the gas; and the Company at length agreed to remove the works to Waddon. There they had remained; and he hoped the prosperity that had attended them would continue. Mr. Hyslop was thanked for his interesting statement; the Chairman remarking that it testified to the continued clearness of his memory.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY (Mr. Alfred Lass, F.C.A.) having read the notice convening the meeting, the Directors' report and the accounts, to which reference was made in the JOURNAL for the 20th ult., were taken as read.

The CHAIRMAN said that, but for the exceptional weather which had been experienced in the past half year, there would have been little for him to say upon the balance-sheet. Dealing first with the accounts of the gas undertaking, they showed an increased revenue from gas amounting to £388. The residual products, however, had all turned out badly. Coke had returned about the average; but sulphate of ammonia and tar were below—the result being that on residuals they had received less than in the corresponding period of 1894 by £157. In the half year, they made more gas by 3,563,000 cubic feet; they sold an additional 2,553,000 cubic feet; and the unaccounted-for gas was 955,000 cubic feet more. Owing to the severity of the winter, no less than five of the gas-mains were split, which caused the unaccounted-for gas to be more than 8 per cent. of the make in the half year. At Lady-day last, the price of gas was reduced 2d. per 1000 cubic feet; and he had been curious to know whether this had produced any beneficial effect on the sale of gas. He found, by comparing the three months commencing Lady-day last year and the corresponding quarter of this year, that 138,000 cubic feet more gas was sold. But this was only the normal quantity; and so far as he could see, no increase in the consumption had arisen from the reduction. It was therefore clear that the increased sale of 7 or 8 per cent. in the six months was only due to the cold weather at the beginning of the year. The revenue from gas was only £237 more than it was in the first half of last year. Looking at the other side of the accounts, with an extra outlay for the renewal of mains and £109 more for rates and taxes, the expenditure amounted to £6310, as against £5912; resulting in a less profit by £161 than in the June half of last year. Regarding the water undertaking, more water had been sold; and the revenue for the half year was £527 more. This showed a very healthy state of things; and with the normal increase continuing, there was every prospect of a good year. Turning, however, to the opposite side of the accounts, maintenance and repair of mains (which in the June half of last year cost £139) in the past six months had cost £770—no less than £631 more. Then the rates had increased by £137; so that the gain in the water revenue was considerably more than swallowed up. The expenditure amounted to £4029; and last year it was £718 less. The result of the working of the water undertaking was that there was a profit of £4837, or a decrease of £191. Respecting the frost, it began at Barnet on Dec. 31, on which day their Engineer (Mr. T. H. Martin) registered a temperature of 18¾°. This extreme cold continued, with the exception of a week in February, to the middle of March. It was experienced most severely at the beginning of February. On the ground, Mr. Martin registered on the 6th 4°; on the 7th and 8th, the temperature was at zero; on the 9th, it was 1½°; 10th, 1°; 12th, 8°; 13th, 2°; and 14th, 1¾°. In all his experience, which had been a long one, with respect to temperatures, he (the Chairman) had never known such consecutive low temperature. The mean for the month on the ground was only 13¾°. The temperature on Feb. 7 in the air was down to 1°, which was lower than he had ever experienced, except in a balloon. The lowest he had ever registered was 5° at Blackheath in 1855. The mean for February, in the air at Barnet, was 18°. On 26 days, the minimum in the air was below 32°; and on some days, the temperature of the air was below 32° during the whole 24 hours. The greatest depth from the surface to the top of their mains was 2 ft. 4 in. to 2 ft. 6 in.; and the least depth was 1 ft. 6 in. The temperature of the water on entering the mains was always 54°, or 22° above freezing-point The frost penetrated into the ground more than 3 feet. The water, however, was not frozen in any main, except when the circulation had been stopped by the service-pipes being blocked. The main that was closest to the surface—1 ft. 6 in.—was never frozen throughout the whole of the cold weather. This brought him to the effect upon the Company's system. They had from 7000 to 8000 consumers; and if they had all done as he did—poured hot water upon the ball-cock every morning until it worked freely—many of their services would not have frozen. At Barnet they had two districts—the north, in which the ground had some gravel mixed with the clay; and the south, in which it was all clay. In the north district, owing to the frost, they had 13 2-inch pipes broken, and in the north 25. Of 3-inch pipes the figures were 40 and 23 respectively; of 4-inch pipes, 11 and 13; and of 6-inch pipes, 1 was broken in each district. Altogether they had 127 fractured pipes. The stand-pipes fixed in the North district numbered 88, and in the South district 180—making together 268. In one case, Mr. Martin had to open the ground for ¾ mile, in order to melt the ice to allow of the stand-pipes being used. The winter had been a very exceptional one; and, in his (Mr. Glaisher's) report to the Registrar-General in April, he stated that February had been the coldest period experienced in England since 1771. Having referred to the drought which succeeded the cold weather, and which necessitated pumping day and night, he said there was one other matter to which he wished to allude. As the shareholders were aware, they had been trying to obtain another source of water supply. They had already spent a large sum upon the Finchley works, to get water from there. Part of this expenditure not being productive, the Board had considered it advisable to write off out of revenue a further sum of £500; so as not to charge it to capital. They

had now bought a piece of land at Potters Bar, and had sunk a bore-hole there to the depth of 372 feet. The water had been analyzed, and reported by Dr. Frankland to be very good. They were hoping now to get water from this neighbourhood; so that in future when they had to carry on work at the bottom of the wells at Barnet, no consumer would know of it by the chalky appearance of the water. He concluded by moving the adoption of the report and accounts.

Mr. C. HORSLEY, J.P., seconded the motion, which was unanimously carried.

Dividends were then declared, less income-tax, at the rate of 9 per cent. per annum on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. per cent. on the "D" capital gas and water stocks.

The CHAIRMAN moved a vote of thanks to the officials (Messrs. Lass, Martin, and Wright) and their staffs.

Mr. I. A. CROOKENDEN seconded the motion, which was heartily agreed to.

The proceedings concluded with a vote of thanks to the Chairman and Directors, proposed by Mr. MAGNUS OHREN, and seconded by Mr. CECIL.

NEXT YEAR'S EXAMINATIONS IN GAS MANUFACTURE.

Those of our readers who contemplate submitting themselves as candidates at the next examinations in "Gas Manufacture" by the City and Guilds of London Institute will doubtless be glad to learn the nature of the questions that will be put to them by the Examiner (Mr. Alfred Colson, M.Inst.C.E., of Leicester). This they will be able to do from the "programme" of the Institute for the season 1895-6, which has recently been issued by Messrs. Whittaker and Co., of Paternoster Square, at the price of 10d. net., or with postage 1s. 2d. The book furnishes full particulars, in regard to the examinations in all the subjects taken up by the Institute, and gives a mass of information likely to be of use to students. The examinations in "Gas Manufacture" will be held on Tuesday, May 5, 1896, from 7 to 10 o'clock p.m.; and the questions in the Ordinary Grade will be founded on such subjects as the following:—

1. The construction of a retort or oven best adapted for the destructive distillation of coal. 2. The setting of retorts, and the construction of retort-furnaces. 3. The effects of temperature in modifying the quantity and quality of the gas produced. 4. The description and arrangement of apparatus employed for the conveyance of the gas immediately upon its leaving the retorts. 5. The description of apparatus best adapted for cooling the gas. 6. The most suitable condition of the gas for effective purification. 7. A description of the various instruments used in gas-works for ascertaining and recording pressure and exhaust. 8. The laying of mains and service-pipes. 9. The construction of gas-meters. 10. The fixing of meters and the fitting up of premises for the supply of gas. 11. A description of the various kinds of gas-burners in general use. 12. The use of an exhauster. 13. The methods employed for controlling pressure at the works, so as to secure an adequate supply of gas at the various points of consumption, with a due regard for economical effect. 14. The simplest methods of ascertaining the purity and illuminating power of gas. 15. A description of the materials and methods employed for the purification of gas. 16. Influence of temperature and atmospheric pressure upon the volume of gas. 17. A description of the various tests employed for determining the values of ammoniacal liquor and spent oxide.

In the Honours examination, more difficult questions will be set in the above subjects, and, in addition, a knowledge will be required of—1. The characteristic properties of the various kinds of coal, and their value for gas-making purposes. 2. The effects of temperature upon the production of residuals. 3. The chemical composition of coal gas. 4. The chemistry of purification. 5. Gas analysis. 6. The development of illuminating power. 7. The practice of photometry. 8. Labour-saving appliances in the retort-house, and the working of retorts. 9. The construction of gasholders, purifiers, and other gas apparatus. 10. The working up of ammoniacal liquor. 11. The principles of combustion, and their application to the working of retort-furnaces. 12. Carburetted water gas. 13. The enrichment of coal gas by means of oil, &c.

As mentioned in previous notices of the "programme," it contains a list of teachers competent to give instruction in the various subjects; and a large section of it is occupied with the questions set at the last examinations—accompanied by diagrams where required—with the maximum number of marks allowed for each question. The papers in "Gas Manufacture" were given in the JOURNAL for July 2 last (p. 44). In the Ordinary Grade, the 300 marks were divided equally between the ten questions. In the Honours Grade, they were divided as follows: 30, 30, 20, 30, 35, 35, 30, 30, 30, 30.

An allied subject is that of "Coal Tar Products," the Examiner in which is Mr. Arthur G. Green. The examination will take place on May 5 next, from 7 to 10 o'clock p.m.

THE INTRODUCTION OF GAS LIGHTING IN DURHAM.

An Interesting Record.

We have received a copy of the *Durham County Advertiser* for Jan. 3, 1824, containing an account of the first lighting of Durham with coal gas. The paper is interesting in several respects. It was the first newspaper established between York and Newcastle; it was a 4-page sheet, rather smaller than *The Times* of to-day; and its price was 7d. The introduction into the northern cathedral city of what was then the new illuminant, is thus recorded—

This city was partially lighted with coal gas on the evenings of Saturday and Sunday last [Dec. 27 and 28, 1823], and was generally illuminated with the same brilliant material on Monday evening, and every night since. The change which this substitution of gas for oil has effected is perfectly surprising, for we behold a city, long notorious for its nocturnal darkness, become at once, perhaps, the very best—at all events one of the best—lighted towns in the kingdom. The street-lamps, which are of a most elegant form, are placed much nearer to each other than is usual in most towns; and this circumstance, added to the brilliance of the flame they contain, completely fills our narrow streets with a bright, yet beautifully soft and pleasing light. The general lighting up of the city on Monday evening excited a great sensation; and a band of music, which paraded the streets in compliment to Mr. West, the spirited proprietor of the gas-works, was attended by some hundreds of men, women, and children, as anxious to feast their eyes on the improved appearance of the town, as to gratify their ears with the music. The bell-ringers of St. Oswald's also complimented Mr. West with a merry peal, on the successful completion of his arduous undertaking. We cannot close this article without offering our congratulations to our townsmen on the *enlightened* state of the city, nor without bearing testimony to the liberality of Mr. West, who has, at his sole expense, erected the works, laid the pipes, and provided the lamps; engaging to light the town with gas for the same sum per annum that the lighting it with oil has hitherto cost. Thus Durham has exchanged a light barely sufficient to render "darkness visible" for one of great beauty and brilliancy, without having been at a farthing expense. On Wednesday evening last, a beautiful effulgent gas-star, having in its centre the letter W, was exhibited over the Piazza in the Market Place, and attracted vast crowds of spectators, who generally expressed themselves in the highest terms of admiration. This star, which would have been displayed on Monday evening but for the boisterous state of the weather, was planned, made, and exhibited by Mr. West's foreman, in compliment to his employer, to both of whom it certainly did great credit. The bells of St. Nicholas rang merrily during the time of the exhibition.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chief Engineer's Report on Available Sources of Water Supply.

(*Continued from p.* 450.)

IV.—*Disposal of the Available Sources of Supply.*

As it is clear that the Metropolis does not yet require so large a supply as that which can be obtained in Wales, and as it is important so to lay out the works that they can be gradually extended as time goes on, we have to look to the most economical arrangement for availing ourselves of the bountiful supply above spoken of. In connection with this, and considering the importance before mentioned of preserving in the future two independent lines of communication, we can at once divide the above sources into two portions of approximately 200 million gallons a day each. One of these portions would include the Llangorse and Usk with the Edw supplies. These yield respectively 182 and 18 million gallons, or a total of 200 million gallons a day. The second division would include the Yrfon and Towy supplies, 135 millions; the Ithon, 37 millions; and the Upper Wye, 43 millions—a total of 215 million gallons per day.

When I come, in a later portion of this report, to speak of the aqueduct which will convey the water to London, it will be found that I propose to form this in two channels, each of a capacity of about 200 million gallons a day. Therefore we may, for the purposes of this part of the report, divide the scheme into the two portions above spoken of—viz., the Usk, Llangorse, and Edw; and the Yrfon, Towy, Ithon, and the Upper Wye.

But as a preliminary in carrying out the earlier portion of the scheme, it might suffice to take in, as a first instalment, the Upper Usk and Llangorse; leaving the Edw to be added when time requires. In the same way, in constructing the second portion of the scheme, embracing the Yrfon, Towy, Ithon, and Upper Wye areas, the Yrfon reservoir could first be constructed, with which the supply from the Towy could be brought in. This, when exhausted, could be supplemented from the Ithon; and ultimately the Upper Wye source could be rendered available. Advantage will be taken of the great benefit that is derived from decanting one reservoir into another, so as to ensure a due settlement to the largest possible extent by causing the Upper Wye reservoir, the top water-level of which is 900 feet, to discharge into the Yrfon reservoir, the top water-level of which would be 606 feet. In like manner, the reservoir on the Ithon would discharge into the reservoir on the Edw. The first section of the main conduit to London would start from Llangorse; the main conduit for the second section would start from the reservoir on the Yrfon.

By the above scheme, I think I have laid out the works with the greatest economy, having regard to the gradual utilization of the various sources already described.

V.—*Main Aqueducts to London.*

The above being the arrangement by which the whole scheme of works is divided into two main portions, it will be understood that, in the completion of the whole scheme, two separate aqueducts would be required. There is also another point which I think is deserving of attention, and which arises out of the fact that London is divided in the proportion of about six to four by the River Thames; and as the population increases on the south side of the river, which is at present less built over than the area lying north of the Thames, we may anticipate that, in all probability, the London of the future will be pretty evenly divided by that river. Consequently, looking to a complete scheme of works fifty years hence, it would be advisable, if possible, to avail ourselves of the two aqueducts which we contemplate to afford us an independent supply on both the north and south sides of the Thames, and which, being situated at about equal altitudes, would permit of the water flowing indifferently from either aqueduct through the old distribution pipes of the Metropolis.

These general principles being understood, there are two possible lines of aqueduct from Wales to London. One, which I will call the northern or midland counties line, would be carried along a line which,

starting from Hay in the Wye Valley, would pass north to Leominster, cross the Severn south of Stourport, north of Bromsgrove, south of Warwick and Leamington, touch the watershed of the Thames north of Banbury, and, going south of Buckingham, pass south of St. Albans to a proposed service reservoir situated a little to the north of the Elstree Hills.

The second possible line of aqueduct could be made to discharge all its water into the same reservoir situated north of Elstree; but it would be carried in a different direction. Leaving Hay in the Wye Valley, it would pass in a south-easterly direction, crossing the Wye south of Ross, tunnelling through the watershed between the Wye and the Severn, a little north of Micheldean and under Mayhill, it would cross the Severn by a syphon-pipe 13½ miles in length a little north of Gloucester, and by tunnelling through the Cotswold Hills, it would arrive at a point on the Colne, a tributary of the Thames, about two miles east of the village of Chedworth, at a place south-west of Northleach. This point on the Colne would be the spot at which a southern line could be carried for the supply of the south side of the Metropolis. That for the north would pass north of Witney and Woodstock, and, crossing the Cherwell, would pass south of Buckingham, eastwards of Aylesbury, and westwards of St. Albans to the before-mentioned reservoir near Elstree.

The southern line, to supply the south side of London, which would commence at the Yrfon reservoir west of Builth on the Wye, would pass down that river to near Hay, when it could be carried parallel with the before-mentioned line by way of Ross and Gloucester to Chedworth, from which point it would branch off south-eastwards; passing east of Swindon, a little to the south-west of Hungerford, north of Kingsclere, south of Basingstoke, midway between Farnham and Aldershot, south of Guildford, and along the downs to its termination at Banstead.

These being the possible lines along which an aqueduct might be carried, it becomes somewhat important to consider for a moment their respective advantages. It is clear that what I have called the northern or midland counties line does not lend itself very well to a supply for both sides of the Metropolis. It would be some 13½ miles longer than the northern branch of the southern line; it would have longer syphon-pipes, and would consequently require a greater head of water to overcome friction; so that the water delivered by it could not be discharged at so high a level as that carried along either of the other lines. On the other hand, there is no doubt that, if the supposed security of the London Water Supply from the attacks of a foreign enemy are to be taken into account, it runs along a line of country farther removed than either of the southern lines from our southern coasts, and consequently would presumably be less open to attack.

This also is an advantage possessed by the northern branch of the southern line, which passes from Chedworth by Buckingham to Elstree; but as I am not one of those who anticipate any danger whatever from this source, I think, on the whole, that the southern line from Hay by Gloucester to Chedworth, with its two branches terminating at Elstree and Banstead, is to be preferred. Consequently, in making my estimates of first cost, I have based them on the supposition that an aqueduct from Llangorse to London *viâ* Glasbury, Hay, Ross, Gloucester, Chedworth, and Buckingham to Elstree will first be adopted. This aqueduct would be 150 miles in length, and would discharge its waters into a reservoir at an altitude of about 312 feet above sea-level.

The second aqueduct, to be constructed at some future date, to bring in the waters from the Yrfon, the Towy, the Ithon, and the Upper Wye, would be parallel to the former from near Glasbury, Hay, Ross, and Gloucester, to Chedworth, and would then pass, by way of Hungerford, Basingstoke, and Guildford, to Banstead. This aqueduct would be 176 miles in length, and would discharge its waters into a reservoir at an altitude of 300 feet above sea-level.

I need hardly point out that the determination of the several routes has occupied me for a considerable time, as they have involved many trial sections, and many considerations too tedious and voluminous for mention in a report like the present, but the result arising out of the study of which I think I have fully expressed in what I have above stated.

Of course, were the northern branch of the southern line—that is to say, from Hay by way of Ross, Gloucester, Chedworth, and Buckingham, to Elstree—first constructed, there would be no reason why the northern or midland counties line, by way of Leominster, Warwick, and Banbury, should not hereafter be adopted; and though I think it would be of advantage, looking to the distant future, that London should be supplied from both sides of the Thames, yet there is no absolute necessity that this should be the case, should further consideration lead to the conclusion that, on the whole, the two northern routes which I have described are to be preferred.

But in my estimates of cost I have assumed that the work will be carried out in two main instalments, with minor additions to each as occasion may require, both common from Glasbury, Hay, by way of Ross and Gloucester, to Chedworth—the one branching northwards by Buckingham to Elstree; the other passing southwards, by Hungerford, Basingstoke, and Guildford, to Banstead. These two aqueducts to correspond with the works in Wales will have a discharging power of a little over 200 million gallons a day each. They would be formed partly of masonry and concrete, and partly of iron or steel pipes at the valley crossings, and would be entirely covered over and free from pollution along their whole length. The masonry portions would be either constructed in tunnel proper or cut-and-cover, and would take the form of a conduit some 16 feet in width, arched over, and in which the water would flow to a depth of about 11 feet—the fall being at the rate of 9 inches per mile. At the valley crossings, the water would be conveyed in parallel lines of pipes, with a fall of 3 feet per mile.

VI.—*Service Reservoirs.*

Though long aqueducts like those above described, when constructed of masonry, may be said to require but little repair or maintenance, yet occasionally, if only for purposes of inspection, the water must be drawn off for a few days. In the same way, the iron pipes may occasionally require repair. Consequently, at the termination of the aqueducts, both on the north and south sides of the river, at Elstree and at Banstead, service reservoirs would be required to contain about 16 days' supply—that is to say, of a capacity of 3200 million gallons each. These reservoirs would form an additional security against breakdowns, and permit of the water being more equally distributed under constant pressure to the Metropolis itself; for it must be remembered that, though the average flow of the aqueduct would be at the rate of 200 million gallons a day of 24 hours, the consumption of water is limited to about one-half of the 24 hours, and being drawn in greater quantities during some portions of the twelve working hours, will require pipes of large diameter to discharge the great volumes of water into the Metropolis.

From these reservoirs, connecting-pipes would be carried down, from which the water would discharge into the existing service and distribution reservoirs of the various Companies, or, looking to the future, into new service reservoirs which in course of time it might be found economical to construct at greater altitudes than those now in use. Consequently, we should make use for the present of the whole of the distributing plant of the existing Companies, and in the future add to it as necessity might require.

VII.—*Filter-Beds.*

Though the Chemist's analyses of the waters of the Usk, the Yrfon, the Towy, the Wye, &c., show that, in their natural state, they are of greater purity and contain less solid matter than the London water after filtration, and though these waters will be stored and be subjected to subsidence in the large reservoirs I have described, and in some cases will be decanted or drawn off from one reservoir into another, yet I consider that, when all precautions are taken, the water should be filtered before delivery to the consumer. Possibly this filtration may not be of so severe a kind as that required by the waters of the Thames, flowing as they do from a richly-cultivated and inhabited area; yet small particles of floating matter may fall into the waters. I think, therefore, the result would be that the filters would require much less attention and cleansing than in the case of the Thames; while the advantage of a pure, clean water, free from every particle of suspended matter, would be secured.

VIII.—*Connection with the Existing Distribution-Pipes.*

This is a matter requiring to be worked out in considerable detail; but in my estimate of cost I have included a sum which I believe to be amply sufficient to afford the necessary lines of communication-pipes with the existing system.

(*To be continued.*)

THE RECENT SCARCITY OF WATER AT THE EAST-END.

Report by the Chief Engineer of the East London Water Company.

In the House of Commons, on the 16th inst., Mr. J. Stuart put to the President of the Local Government Board the following question, of which he had given him private notice: "Whether his attention had been called to the report, dated July 30, of the Chief Engineer of the London County Council, in which, after the examination of certain facts as to the amount of water supplied by the East London Water Company before and after the frost of last winter, that gentleman states as his opinion: 'That what the Company are now suffering from is not an insufficiency of supply, but that their pipes became so shattered during the frost of February last as to become so leaky that the water is wasted and does not reach the consumers;' whether he was prepared to make any inquiry as to the correctness of this opinion; and, if it was correct, whether he would take any steps to require the Company to put their mains in proper repair." Mr. Chaplin could not answer the question—sufficient time had not been allowed him. The Secretary of the Company, however (Mr. I. A. Crookenden), forwarded to the Local Government Board the following report by Mr. W. B. Bryan, the Company's Engineer; and he subsequently sent it to the papers: "I have to state that the theory of the Chief Engineer of the London County Council is based upon a total misapprehension and want of knowledge of the facts. In the first place, every pipe belonging to the Company found damaged by the frost or any other cause within the County of London was replaced and made good by April 8; and every pipe in the County of Essex, by April 19. Since these dates, the Company's servants and contractors have been actively engaged in lowering such mains as, in the opinion of the Company, might at some future time be affected, should a frost as severe and prolonged as that lately experienced occur. A house-to-house inspection was commenced on April 24, and continued until June 29. More than 50,000 lead pipes belonging to consumers were found burst, of which several thousand cases were underground, or 'hidden waste,' ascertained by stethoscoping and in other ways by the Company's inspectors. As every ½-inch pipe running full bore wastes as much as 700 people require for domestic purposes, and as many of these pipes were not repaired in July—there being the greatest difficulty in householders obtaining sufficient plumbers to cope with the magnitude of the repairs required—it will be at once seen that the increase of 25 per cent. of water distributed last May over that of the previous May is easily accounted for. Consequent upon the abnormally dry weather of May and June, garden watering was also a source of very great waste. Several thousand hose-pipes were discovered and reported by the Company's servants as being allowed to waste day and night. Since the intermittent supply was given, each service-main has received a very much higher pressure than can be given when the supply is continuous. If there were the slightest truth in the 'shattered main' theory, each street should, as the water was turned on, have been flooded, and the surface of the road rendered dangerous by the blowing up of the pavement. Such a state of things, however, has not obtained. Upon inquiry as to the relative amounts of water distributed by the large municipal water-works in 1895 as compared with 1894, it has been found that the increase in the volume distributed by the East London Water Company compares most favourably with the increase in other large towns; thus proving the 'shattered main' theory to be untenable."

Deputation of Vestry Delegates to the County Council.

A deputation from the Vestries of Hackney, Shoreditch, Bethnal Green, Limehouse, and St. George's-in-the-East, waited last Tuesday afternoon upon the Joint Public Control and Water Committee of the London County Council, at Spring Gardens, relative to the supply of water furnished to the eastern district by the East London Water Company. Dr. COLLINS presided.

Mr. J. B. KYFFIN (Hackney), in introducing the deputation, said that, in addition to the Vestries represented, the Local Authorities of East and West Ham and Leyton would have liked to join in the protest against the defective supply of water served to the East-end; and they were only excluded for the reason that they did not come within the jurisdiction of the County Council. He thought he should be able to demonstrate that the so-called water famine was no famine at all; that, on the contrary, there had been abundance of water; and that any deficiency in the supply arose purely and simply through the negligence of the East London Water Company themselves. Up to the end of June, there had been a sufficient supply. After that, it became less. However, there was nothing much to complain about until the middle of July; and on the 14th, 15th, 16th, and 17th of that month, they had practically no water at all. The Company showed by their published returns that they did not take the quantity of water they were authorized to draw from the Thames by 5 million gallons. As to other sources, he, in company with others, had paid a visit to the Lea Conservancy offices, where they found that 22¼ million gallons of water were passing over Field's Weir, on the River Lea. So long as this quantity was passing over the weir, the Company could take all the water they wanted. From July 16 to 21, this quantity had decreased to 18 million gallons; but on the latter date, it was restored by pumping the contents of the locks back again to the higher levels. So that, with the exception of five days during the present summer, they had the assurance of Mr. Child, the Engineer to the Lea Conservancy, that a sufficient quantity of water for navigation purposes was passing over Field's Weir. And yet during this period of scarcity, the Company were selling to the Hackney Vestry alone something like 500,000 gallons a day. Quite recently, the Directors of the Company had augmented their supply by purchasing 4 million gallons daily from the New River Company. But why, if reduced to such a predicament, had they not done this long before? for that was a source that had always been open to them. Then, throughout the period of scarcity, the supply of water for the roads and for the purposes of the large breweries, which was paid for by meter, was always abundant. As a matter of fact, all the figures that had been adduced went to show that the Company, by the exercise of ordinary care, could have easily provided for the needs of East London. The Vestries felt that in this matter the County Council had not done what they might; for the Act of 1871 distinctly conferred powers upon the Metropolitan Authority to recover penalties where a water company did not provide a sufficient supply. The deputation came there as delegates from a conference representing 1¼ million of people, and asked the Council, as the properly-constituted authority, to enforce the penalties.

The EARL of ONSLOW inquired if they in any way attributed the deficiency in the supply of water to the shortness of the rainfall.

Mr. KYFFIN replied that they did to a certain extent; but, inasmuch as the Company at one time drew only 5 million gallons from the Thames, instead of double that quantity, to which they were entitled, and whereas, too, most of the water from the Lea was derived from underground sources, they failed to see that the drought had much to do with the situation.

Mr. IDRIS: Could they have obtained any more from the New River Company? Have you any evidence to prove this?

Mr. KYFFIN: Yes.

Questioned by another member of the Committee, Mr. KYFFIN said that, during all the period of scarcity, the Company were supplying Tottenham, where no question of statutory liabilities arose, and starving the east of London. What the Vestries strongly recommended the Council to do was to proceed against the Company for penalties.

Mr. IDRIS: You know the penalties are rather limited?

Mr. KYFFIN: It is £200 for every offence; and in Hackney alone the penalties that could be successfully enforced would cost the Company £70,000.

Dr. BOND, M.P.: I am interested in some property in Spitalfields. I have caused inquiries to be made; and I do not hear of great privations being endured.

Mr. KYFFIN: They were selling water at 1d. a bucket in Spitalfields.

Mr. ROSE-INNES: Can you suggest any reason why the Company did not pump a larger supply from the Thames?

Mr. KYFFIN: I believe their reservoirs are too weak.

Mr. ROSE-INNES questioned Mr. Kyffin at length as to the manner in which he construed the sections of the Acts dealing with the subject.

Mr. CROOKS objected to this process of cross-examining gentlemen who had come there to lay their case before the Committee in a straightforward manner.

Mr. ROSE-INNES said he was fully in sympathy with the object of the deputation; but it had been asserted that the County Council were to blame for not having taken action in this matter.

The CHAIRMAN ruled that it was a point which could be argued with the deputation.

Further questions having been addressed to the deputation respecting the drawing up of detailed returns in the several districts represented by the Vestries,

The CHAIRMAN intimated that the Committee had been very pleased indeed to listen to the statements laid before them by the deputation. The Council were fully aware of the importance of this question; and Counsel's opinion had already been taken as to whether an action against the Company would lie under the Act of 1871. So far as it went, that opinion did not point to the successful issue of such an action; and it would be for the Committee to consider again whether they should be guided by Counsel, or seek for further information. One thing was certain—viz., that they would do all in their power to secure an efficient supply of water for the East-end of London.

The deputation then withdrew.

Deputation to the Local Government Board.

Last Friday, a numerous deputation, introduced by Sir Andrew Scoble, Q.C., M.P., waited upon Mr. Chaplin at the Local Government Board, in order to urge the necessity for an inquiry into the supply of water by the East London Company. The deputation was the outcome of the recent conference of Vestries and District Boards within the Company's district; and accompanying the representatives of these bodies were several local members of Parliament.

Sir A. SCOBLE, in introducing the deputation, said they were there to complain that the supply of water by the East London Company was deficient, and to ask the Local Government Board to institute an inquiry into the matter under the Metropolis Water Act, 1852.

Mr. J. B. KYFFIN said the district represented had suffered severely from scarcity of water; but, before taking any steps in the matter, they made careful inquiry as to whether or not the Water Company had been absolutely prevented by drought from supplying water. They were, however, now convinced that the imperfection was due to negligence. The Company had supplied the Tottenham Local Board with 3 million gallons, though they were under no statutory obligation to do so; while those whom they were bound to supply had suffered drought. The Company had not utilized to the full their statutory powers; and, instead of taking 10 million gallons from the Thames, they only took from 5 to 7½ millions. Action had been attempted by individuals under the Act of 1871; but it was encompassed with legal and technical difficulties. One case, however, was reserved for the consideration of the High Court, and was awaiting decision. Their complaint was that statutory obligations were neglected, and those which were not statutory were fulfilled. The public health had suffered; and mortality had increased in the district to a far greater extent than in other places.

Mr. SMITH (Limehouse) thanked Mr. Chaplin for the personal interest he had taken in the question of water supply. There was, he said, a diversity of opinion on this matter, and it was absolutely necessary that a searching inquiry should be made—not for vindictive purposes, but to prevent a recurrence of the dreadful evils which had been caused. The whole subject should be sifted to the bottom. It was only due to a marvellous Providence that there had not been a devastating epidemic in the East-end.

Other members of the deputation having spoken,

Mr. CHAPLIN said: I need hardly assure you that I have listened with the deepest interest, and with all the attention I could give, to the very serious and grave statements which you have put before me. I think I may say that, from the very earliest moment that this question was brought under my notice, very shortly after my appointment to the position I fill, I have recognized its extreme gravity. There was one fact alone which I think was sufficient to demand the earnest attention of any statesman who shares any responsibility in the matter—viz., that in a district which is one of the poorest parts of London, and contains a population of 1¼ millions, we are confronted with the state of things that for a certain time during the hot weather the water supply was limited to two hours out of the twenty-four. I do not think, though much has been said to-day to reinforce the gravity of the situation, that anything further than that simple fact was required; and if I had wanted anything to confirm my opinion on this subject, I should have found it in the touching appeals made to me by Mr. Kyffin, Mr. Smith, and others. Though it is quite true that I may not have seen all there was to be seen when I visited that part of London myself, I was never so filled with anxiety by a question, and by the earnest desire to see what remedy could be applied in the future, as I was on the occasion of that visit. I need not tell you that you may put utterly on one side, as wholly unworthy of notice, any idea that I should refuse any redress, improvement, or relief which can possibly be afforded. Mr. Kyffin and Mr. Smith have both laid before me a great number of facts which I need not tell you will receive my most careful and serious consideration. It is not necessary for me to deal with them in any detail this afternoon. But my experience of life has always told me that there are generally two sides to a question; and, in common fairness to the East London Water Company, I ought not to omit to state what is their side, and the reasons which they allege to account for the deficiency of the supply. The first is the unusual drought, which Mr. Kyffin does not believe in. Secondly, the insufficient amount of storage, caused mainly, as they allege, by the action of Parliament in 1893. Thirdly, the considerable breakage which occurred in a large part of the consumers' pipes, owing to which there has been an enormous waste of water supply. As to how great that waste has been, gentlemen will form their own opinions. The Company put it down at 50,000 pipes of consumers alone. They have also supplied me with some figures as to the enormous waste caused by the breakage of each ¾-inch pipe. I am, of course, expressing no opinion whatever on the correctness of these statements, or on yours. Then there is another serious question I have to consider—that is the legal one—as to the precise powers of this Department in instituting such a great inquiry as is demanded, especially with regard to the fact that the water supply has not been constant. That is a point about which I can inquire without a moment's unnecessary delay, and ascertain precisely what powers the Department possesses. But, after all, the real question is this: We want to avoid this condition of things in the future. I would rather reserve my final decision on that point. But thus much I am ...tified in saying to you—that I am not able myself to see any insuperable objections to the inquiry you demand. On the other hand, I think probably there may be considerable difficulties in such an inquiry. In any case, you may be sure that I thoroughly recognize the extreme gravity of the situation. There is no doubt that, a short time ago, we were within an ace of a great disaster; and I do not think Mr. Smith was going too far when he said that we had a providential escape. I approach this question animated by one feeling alone, and that is a real and impartial desire to do whatever is possible to avoid the recurrence of such a calamity as that through which that part of London has recently passed; and I will take the earliest opportunity of communicating my final decision on this question.

Mr. S. BUXTON, M.P., thanked Mr. Chaplin, and the deputation withdrew.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The accounts of the Aberdeen Corporation Gas Department for the year ending July 31 last have been issued. I expected them sooner; but I seem to have been mistaken as to the date upon which they close. Formerly it was on Sept. 30; and I thought that the date had been altered to May 15, so as to correspond with the date of closing of other municipal accounts. This has not been the case, which is very strange, as I understood they wished the accounts to all come in together. What is more peculiar is that, while the gas accounts close on July 31, those of the Electricity Department, which is managed by the same Committee of the Town Council, close on Dec. 31. This tends to confuse matters, and prevents an intelligible view being taken of how the businesses work.

For the past year, in the Gas Department the revenue amounted to £76,821; and the expenditure, to £64,944—leaving a gross surplus of £12,877. From this sum, however, annuities amounting to £5165, depreciation amounting to £4642, and charges for reserve and sinking funds, fire insurance, &c., had to be provided; and the loss on the electric lighting department, amounting to £217, had to be made good. The result is to bring out a deficit of £398. A year ago, it may be remembered, a reduction of 3d. per 1000 cubic feet of gas was made; so that the result comes out, considering the difficulties of the past year, quite satisfactory. Had it not been for the miners' strike in the summer of 1894, and the severity of last winter, I have no doubt but that there would have been a good surplus. As it is, the Gas Committee are not, to speak colloquially, out of funds, for they began the year with a surplus, carried forward from the previous year, of £6747; and they have now in hand £6349. Of the revenue for the past year, £65,456 was derived from the sale of gas; £11,010 from the sale of residual products; £246 from gas-stoves; and £103 from rents and feu duties. The manufacture of gas cost £47,634, of which coal amounted to £34,439; wages, £7461; maintenance of works and plant, £3000; distribution, £2092; rents, rates, and taxes, £4980; management, £1916; and discount and bad debts, £2503. The Gas Committee, in considering the accounts last Wednesday, were of opinion that the proposed reduction in the price of gas from 3s. 5d. to 3s. 3d. per 1000 cubic feet, would leave them, as estimated, at the close of the current year, a surplus of only £53, which would be insufficient to work upon; and they resolved to recommend that the reduction should be to 3s. 4d., which would leave an estimated surplus of £1719. The quantity of coal carbonized during the year was 42,698 tons—the average price of which was 16s. 1½d. per ton. The yield of gas was 430,569,000 cubic feet, or an average of 10,084 cubic feet per ton. Unaccounted-for gas amounted to 8·77 per cent., as compared with 7·64 per cent. in the preceding year, and 10·05 per cent. in the year before that. During the year, 129 annuities were redeemed, at a cost of £1117.

In the Electricity Department, the revenue from Jan. 1 to July 31 was £2975, of which £2704 was derived from the sale of current, and £154 was received for current supplied to ten public lamps. There was a deficit of £109 during the seven months. The quantity of electricity generated was 118,193 units. There was suppled to private consumers 98,122 units; and to public lamps, 8163 units—leaving 10,338 units, or 11 per cent., unaccounted for.

The Edinburgh and District Water Trustees have had plans prepared for a portion of the new works in connection with the augmentation of the water supply, which they are to take from the Talla, in the upper part of Peeblesshire. Tenders are being invited for the construction of the work. The works in immediate contemplation are a railway, 8½ miles in length, from the Caledonian Railway Company's branch line to Peebles, which it leaves about a mile to the east of Biggar station, up the valley to near the site of the proposed embankment of the Talla reservoir; a road near Tweedsmuir village, including a bridge over the Tweed; and a line of cast-iron pipes across the valley of the Tweed and partly along the new road. The Water Trust are to double the Caledonian Railway from Biggar to the junction where their service railway leaves it. The service railway, which, of course, is to be used for the conveyance of material, and of the contractors' plant and workmen up to the Talla reservoir, has a heavy gradient; the steepest portion being 1 in 50. The contract provides for offers being obtained for the permanent way in double-headed rails, equal to those on the Peebles branch of the Caledonian Railway, or alternatively flat-bottomed rails of a lighter weight suitable for the contractors' uses. The object of this is that, when the estimates are submitted, it should be determined whether the heavier or the lighter section of rail should be taken. The heavier would, of course, be preferable, in case the railway should ever be adopted permanently. The new road as agreed upon between the Trustees and the County Council is to be made 15 feet wide, branching off the main road about a mile above the Crook Inn. In room of an old narrow existing bridge at Tweedsmuir, there will be a bridge 15 feet wide between the parapets, 100 feet span, and with small arches for traffic on both sides of the river. This bridge will carry two lines of 36-inch cast-iron pipes below the roadway, capable of conveying 24 million gallons of water per day. It will accommodate the road traffic ultimately; but in the meantime will be used for the service railway, which runs up on the eastern side of the hill to the Talla embankment. This road willultimately be carried all the way up on the east side of the reservoir to Gameshope. The bridge is to be constructed of steel girders, with abutments faced with granite at the corners, and four polished granite slabs for inscriptions. It is provided by the contract that the works are to be completed within twelve months from Sept. 1. The whole arrangements are approved of by the County Council and Road Trustees.

Copious rains—rather too copious, I am afraid, to be agreeable to the holiday-maker, or profitable to the agriculturist—have fallen of late in Scotland. Still the quantity which has fallen this year is less than it was last year; a general average being 24½ inches, compared with 30 inches last year. There is a feeling that, for this season, water supplies are everywhere assured. There is this peculiarity about the present year, that nearly the whole of the rain which has fallen has been during the past three months. In January, there was a good deal of snow; but there was little "rainfall" in it. February and the greater part of March were frosty months, with little falling moisture in them; April gave a few showers; but in May, in some parts of Scotland, not a single drop of rain fell—a most unusual circumstance. It was only with the advent of June that anything like rainy weather began. August has been the wettest month of all. Till it came, there was much shortness of water, so much so that in one place—Airdrie Sheriff Court, I think—people who did not reside within the area of water supply were prosecuted for stealing water from a well within the area. With the quantity of rain which has fallen of late, there is no longer any cause for alarm as to gravitation supplies of water.

One effect of modern legislation, which I have before mentioned as likely to exercise no inconsiderable influence upon rural life, has become manifest this week. In the extension of the powers of local government which have been conferred by recent Acts of Parliament, there have been enactments which bring the powers of local authorities in rural districts up to almost the level, in many instances, which has been attained by urban communities in their Special Acts. These refer chiefly to matters of public health. But what I have more particularly in my mind are provisions with reference to water supply and public lighting. On these matters, County and Parish Councils are armed with very strong powers; and they are exercising them, very much to the disgust of old-fashioned people. One notable instance is the County Council for the Middle Ward of Lanarkshire, who are expending a very large sum in providing a supply of water for the different villages and hamlets in their district. This week I notice that in two places—one in Lanarkshire and the other in Stirlingshire—movements have been commenced for having the public lighting of the places taken over by the Parish Councils. Looked at financially, these local schemes are small; but their effect is far-reaching. Dwellers in cities enjoy the comforts and the advantages, from a health point of view, of many arrangements which have hitherto been unknown in country districts. Yet a very large proportion of the city populations are in the habit of finding their way, during summer, to rural retreats, in which to spend a holiday; and many of these places have hitherto been, in point of darkness, the extreme of unpleasantness, and in point of water supply and sanitation, veritable death-traps. Thanks to the general rise in the conditions of living, which has been characteristic particularly of the past quarter of a century, this is now a matter of the past; and in a few years we may expect that not only villages and hamlets, but even solitary residences in secluded parts, will compare well, in the matter of healthful surroundings, with dwellings in large and populous places. Meanwhile, the taxation to provide these improvements may be grudged by some people; but the effect on the health and well-being of the country at large cannot fail to be great.

An action of some interest relating to the use of destructors for the disposal of city refuse has been heard by Lord Stormonth Darling in the Court of Session; and his Lordship has given judgment in it. About two years ago the Edinburgh Corporation erected a destructor upon land in the outskirts of the city; and they have continued to work it. The pursuers in the action complained that its operation constituted a nuisance to them, because of the noxious smells which emanated from the place, and on account of dust and half-consumed paper and the like which the wind carried from it into their grounds. Evidence was led at great length in the case, in the course of which the Judge had more than once to remind the parties that he was not trying any question as to the capability of the particular destructor, but simply whether it had been worked so as to constitute a nuisance. In his judgment, he has found that a nuisance existed in the earlier stages of the working; but that the remedial measures adopted by the Corporation after the raising of the action had abated the nuisance to some extent, and that it was reasonable that time should be allowed for the effecting of still further improvements, so that if possible all cause for complaint should be removed. He accordingly remitted to Mr. B. H. Blyth, C.E., of Edinburgh, to visit the place from time to time, and, after consulting with Professor Odling, of Oxford, to report on the working of the apparatus. The result of the remit will be watched with some interest, because, if it should turn out that this particular destructor, which was selected with the utmost care by the advisers of the Corporation, cannot be worked without creating a nuisance, a great blow will be struck at a method of improving the sanitation of towns which has of late years become popular.

The Falkirk and Larbert Water Trustees last year had a revenue of £5662, which was £73 less than in the preceding year; but the decrease was due to a reduction of 2d. per pound of assessment. Otherwise there would have been, from an increased valuation and the extended use of water for trade purposes, an increase in the revenue. The expenditure amounted to £6056—an increase of £598 upon the amount in the preceding year, which was chiefly due to outlays in connection with the strengthening of the reservoir embankments and the extension of the distribution system.

Sale of Shares.—Last Wednesday, Mr. W. F. Bowden sold in Durham £10,000 of 4 per cent. preference stock (£5 nominal value) of the *Consett Water Company;* being part of the capital authorized to be issued under the provisions of the Consett Water Act of last year. The highest price realized per share was £6 10s.; the lowest, £6 2s.

The Hermite Process.—The War Office have instructed Messrs. Paterson and Cooper to proceed with the erection of the Hermite sanitation plant at Netley Hospital; and the Corporation of Cape Town have ordered plant to produce electrolized sea water, with a view to the Hermite process being applied to the sanitation of the town.

Incandescent Gas Lighting.—According to *Industries and Iron*, a new incandescent gas-light, to which the name "Excelsior" has been given, is being put upon the market by Messrs. Goltsepke and Co., of Berlin. Hitherto the sale of the Welsbach light in Switzerland has been controlled by the Austrian Auer Company through an agency located in Zurich. We learn from the above-named source that a company has been formed, with a capital of 500,000 frs. (£20,000), for the manufacture and sale of the light in Switzerland, to be known as the Swiss Incandescent Gas-Light Company.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug:* 31.

Sulphate of Ammonia.—There has been a fair amount of business doing; but, August contracts being now covered, the market closes quietly at £9 5s. f.o.b. at the ports. Now that London makers are meeting the market freely, there does not seem to be much prospect of immediate improvement in prices, notwithstanding that stocks in the North are understood to be greatly reduced. It would seem that, although sulphate has for some time been much the cheapest form of ammonia, this fact has, so far, not brought about any exceptional demand; but it cannot fail eventually to exercise a material influence upon prices. Dealers, however, are evidently trusting to the approaching season of increased production to keep prices in check, as they are offering over winter months at much under makers' ideas of value in that position.

Nitrate of Soda is quiet at 8s. 1½d. per cwt. for fine quality.

LONDON, *Aug.* 31.

Tar Products.—Benzols are firmer, especially the higher qualities, 90 per cent., and pure. Gas managers are recognizing that benzol is much the cheapest agent for enriching gas. It is now established that, good as acetylene is claimed to be, pure benzol possesses three times the illuminating power of acetylene. This might be expected from its molecular construction. The higher prices for petroleum spirit are also compelling those using it to fall back on benzol; but as this is three or four times more potent than spirit, gas producers will not have cause to regret the change. The pitch market keeps firm, and buyers will now pay pretty well quoted prices for next season's delivery. The creosote and common oil market is extremely dull; and this is all the more remarkable as the production of them just now is at its minimum. There is more inquiry for anthracene; and the reported better trade in alizarine, both in America and in the East, including Russia, is likely to firm this market. The expiration also of the alizarine blue patent is certain to extend the application of that most useful substitute for indigo, and will be bound to reflect itself in the consumption of anthracene. Several important tar contracts have been let during the week, at a remarkable disparity in price; showing that the old speculative spirit still survives among distillers. The following prices mark the week's business: Tar, 18s. 6d. to 22s. 6d. Pitch, west coast, 34s. 6d.; east coast, 37s. 6d. Benzol, 90's, 1s.; 50's, 11d. (country make, ½d. less). Solvent naphtha, 1s. Toluol, 11½d. Crude, 30 per cent., naphtha, 4½d. Liquid creosote, 1½d. Naphthalene salts, 25s. Cresylic acid, refined, 1s. 1d.; brown, 10d. Carbolic acid, 60's, 1s. 6d. Anthracene, "A" quality, 1s.; "B" quality, 10d.

Sulphate of Ammonia is moving off pretty freely; but prices do not improve as was anticipated. The parity value with nitrate of soda should make sulphate much the cheapest fertilizer where nitrogen is required; indeed, sulphate, to be in parity with nitrate, should be at least £10 per ton. Considerable business has been done at the following rates: Beckton, £9 3s. 6d.; London, outside, £9 5s.; Leith, £9 7s. 6d.; west coast ports, £9 6s. 3d.; Hull and Tyne, £9 5s.—all, except Beckton, less 3½ per cent. Gas liquor, 6s. 6d. to 7s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No material change can be reported as regards the condition of the coal trade in this district. Only a very slow demand is coming forward generally, with pits still working short time; and supplies, even with this limited output, are in excess of requirements. For the better qualities of round coal, suitable for house-fire purposes, rather more inquiry is, in some quarters, reported; but generally the business put through continues only of the most limited dimensions. Colliery proprietors, however, who are expecting that the ensuing month may bring forward an increased demand for winter requirements, are holding to their quoted rates. The improvement in the iron trade and the other coal-using industries is not yet influencing to any appreciable extent the demand for the lower qualities of round coal, suitable for iron making, steam, and general manufacturing purposes; and these remain a drug upon the market, with prices weak and irregular where competition from outside districts has to be met. Engine fuel meets with a fair demand at about late rates; but supplies are plentiful, as notwithstanding the restricted output of slack, quantities are coming in from outside districts at very low figures. At the pit mouth, the average prices may be given as about 10s. to 10s. 6d. per ton for best Wigan Arley; 8s. to 8s. 6d., for Pemberton four-feet and seconds Arley; 7s. to 7s. 6d., for common house-coal. Steam and forge coals are readily obtainable at 6s. per ton, although some colliery proprietors hold to 6s. 6d.; and engine fuel ranges from 3s. to 3s. 6d. for common sorts, up to 4s. 6d. and 5s. for best qualities. Derbyshire slack is offering at 2s. per ton at the pit; and Yorkshire slack is also obtainable at very low figures. In the shipping trade, the only noticeable change is perhaps rather more doing in house-fire qualities, which are quoted 9s. 3d. to 9s. 6d. per ton; but steam coal continues excessively low in price—7s. 3d. to 7s. 6d. per ton, delivered Mersey ports, being about the average figures.

Northern Coal Trade.—A steady demand for best steam coals, and an increasing consumption of gas coals, are the chief features of the coal trade of this district during the last few days. There is now a natural desire to get away a large part of the shipments that have been contracted for to the Baltic; and this causes a pressure for the best kinds of coal, so that the producing collieries have a very brisk trade assured for some weeks to come, and can thus ask a relatively high price. For early delivery, 9s. 3d. per ton f.o.b. is the current rate for the best Northumbrian steam coals; whilst for second-class coals, with a less pressing demand, the price varies from 8s. 3d. to 8s. 6d. per ton. Steam small coals are plentiful, and can be had at from 3s. to 3s. 6d. per ton, according to quality; the large production of round coals necessitating a considerable output of small. In regard to gas coals, there is, as we have noted, an enlarging consumption; and thus the deliveries, both for shipment and for local use, have now been considerably increased from the lowest point, whilst every week will now add appreciably to the demand. Much of this fuller request is under contract; and odd cargoes are now quoted about 6s. 3d. to 6s. 9d. per ton f.o.b., according to quality and position of the collieries. As, however, many of the pits are still only working short time—though fuller than they were—there is ample facility for meeting the needs of the users, though a few weeks will see the pits better at work. Manufacturing coal is steady. Coke is also in very fair demand, with some enlargement of the exports, after a long depression. For best Durham coke, from 13s. to 13s. 6d. per ton f.o.b. is the current price. Gas coke is a little more plentiful; but it is finding a fair market at recent prices.

Scotch Coal Trade.—The outlook is more encouraging. There is a steady business doing in all classes of coal, and an improving demand, particularly for splint varieties. Forward orders are also coming in more freely. The improvement has not yet, however, reached so far as market prices, which are still quoted at: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. There is every indication that these rates will soon be exceeded. Shipments for the week amounted to 181,971 tons—an increase over the quantity in the preceding week of 8455 tons, and over the quantity in the corresponding week of last year of 175,565 tons. For the year to date, the total shipments have amounted to 4,738,926 tons—an increase compared with the corresponding period of last year of 989,991 tons. This increase is, of course, accounted for by the diminished volume of trade during the strike of last year.

The Kent Opposition to the London Water Bills.—The Parliamentary Committee of the Kent County Council report that the opposition to the Kent and Lambeth Water (Transfer) Bills promoted by the London Council has involved, up to the present, an outlay of £2000. Of this sum, the Kent County Council have resolved to pay £500 as a fair and equitable proportion of their share in the opposition; the remainder to be liquidated by the joint District Councils in West Kent.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 480.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23½–24½	+½	4 5 8
100,000	10	„	7½	Do. 7 p. c.	10	16—17	+½	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 7
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	„	6½	Do. New	4	5—5¼	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	„	„	9	Do. New	100	200—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125–130*	+2½	3 16 11
320,000	20	28 Mar.	11½	British	20	54—56	..	4 0 4
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½–22½*	..	5 2 2
51,510	10	„	8½	Do. 7 p. c.	10	16½–17½*	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾–8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	29—31	..	5 6 5
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	300—305	..	4 8 6
165,000	„	„	10½	Do. New	100	225–230	..	4 11 4
160,762	„	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270—280	+5	4 12 10
200,000	„	„	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	125–130*	+2½	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	„	11	Do. Partly paid	10	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12½	Gaslight & Coke, A, Ordinary	100	291—296	..	4 6 2
100,000	„	„	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	187—192	..	3 12 11
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	„	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	..	2 19 9
294,850	„	„	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	„	„	6	Do. 6 p. c. do.	100	200—205	..	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	248—253	–1	4 14 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾–6¼	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	115–117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	17½–18½	..	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼–7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5–5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1⅞–2⅛	..	8 0 0
420,000	100	2 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	6 7 3
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	360–370*	+2½	4 3 9
1,350,000	„	„	12	Do. B do.	100	302–307*	+1	3 18 2
308,685	„	„	13	Do. C do.	100	315–325*	+7	4 0 0
800,000	„	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	+1½	2 16 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	224—228	–4½	3 10 2
654,740	„	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303–308*	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258—263	–1½	2 17 0
406,200	100	„	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Aug.	12½	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—145	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	153–158	–4½	2 10 7
126,500	100	„	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290–295	–2	3 7 10

*Ex div.

New Water Reservoir at Rooden.—The Water Committee of the Oldham Corporation lately inspected the work now going forward in connection with the construction of the new reservoir at Rooden. They learned from the Engineers that an impervious bottom for the reservoir had at length been found, and that the work is now going on apace. Thousands of tons of peat have been removed since the first sod was cut; and a special embankment had to be made to prevent the tremendous mass of peat, which was daily moving with the slope of the land, going into one of the lower reservoirs.

The Effect of Reducing the Public Lighting Hours in Liverpool.—It has been frequently said that every public lamp is as good as a policeman; and, consequently, the advisability of keeping the policeman on the watch—in other words, keeping the lamps fully alight—as long as possible would appear to be self-evident. Not long ago, the lighting hours were curtailed in Liverpool, with the result, according to a correspondent to a local paper, that crime has increased in the city. He characterizes the decision to lower the gas as a direct encouragement to the criminal classes. There are some streets, he says, along which it is unsafe for a constable to go after dark; and even there the gas is lowered. It seems that the night-duty men are now provided with lanterns; for, when anyone meets with an injury from assault, a light has to be procured before the wounds can be dressed.

The Price of Gas in Dublin.—The *Freeman's Journal* understands that the Directors of the Alliance and Dublin Gas Company intend to recommend the shareholders to reduce the price of gas; and 2d. per 1000 cubic feet is the amount named—making it 3s. 5d. in the city, with a *pro rata* reduction in the suburban districts. "The 'Gas Question' in Dublin," says our contemporary, "has for a long time past been confined to the controversy between the Corporation and the Gas Company—a controversy which has been fought out in the Law Courts and before other tribunals at great cost, especially to the ratepayers. The important point whether the private consumer paid too highly was more or less lost sight of in the corporate dispute; but many were of opinion that the citizens were entitled to have their gas at a lower price than that charged. The step now advised by the Directors goes far to fix the soundness of this view, and to encourage the hope that, after a reasonable trial of the lowered scale, still further reduction may be ventured upon. It is certain that cheap gas leads to increased consumption."

Purifier Extensions at the New Wortley Gas-Works at Leeds.—The New Wortley Works Sub-Committee of the Gas Committee of the Leeds Corporation have decided to apply hydraulic power to the purifying-boxes now being constructed at those works by Messrs. Clayton, Son, and Co. The overhead crane and manual power system is in operation in connection with the old purifiers.

Reductions in Price.—The Directors of the Heckmondwike Gas Company have reduced the price of gas from 2s. 10d. to 2s. 6d. per 1000 cubic feet net, as from July 1; bringing it down to one uniform figure, whether used for lighting, cooking, or heating purposes. The price of gas at Bungay is to be reduced, as from the 1st prox., from 4s. 10d. to 4s. 7d. per 1000 cubic feet. Owing to the conclusion of exceptionally favourable coal contracts, the price of gas will be reduced by the Douglas (Isle of Man) Gas Company 2d. per 1000 cubic feet.

A New Reservoir for Totnes.—The Mayoress of Totnes (Mrs. A. Michelmore) recently laid the corner stone of the new reservoir at Bowden, the site for which had been obtained by the Town Council from the late Duke of Somerset. The reservoir will be 100 ft. long and 40 ft. wide, and have a depth of 8 ft. 6 in. The cost will be about £650. The Chairman of the Water Committee (Alderman Kellock) gave an account of the extensions carried out since he became a member of the Corporation in 1860; and said their new reservoir would contain from 160,000 to 190,000 gallons of water, which the Committee believed would be ample for the requirements of the town for some time to come. They hoped the rental from the improved supply would enable the Council to pay off the old debt, and reduce the improvement rate.

Increased Water Storage for Washington.—The Washington newspapers announce an important addition to the water-storage capacity of the system supplying the national capital in the completion of the improvements on the Dalecarlia reservoir. The work consisted of restoring the abandoned basin to the water-works system by preventing the drainage into it of polluting water. The work, which presented several difficult problems of engineering, has been done in two years; and the cost has been kept within 150,000 dols. Washington has now an additional reservoir capable of holding 170 million gallons of water. The Dalecarlia reservoir was built some 35 years ago by the late General Meigs, but was abandoned about 10 years ago. Its restoration was designed and carried out by Colonel George H. Elliot, of the Corps of Engineers.

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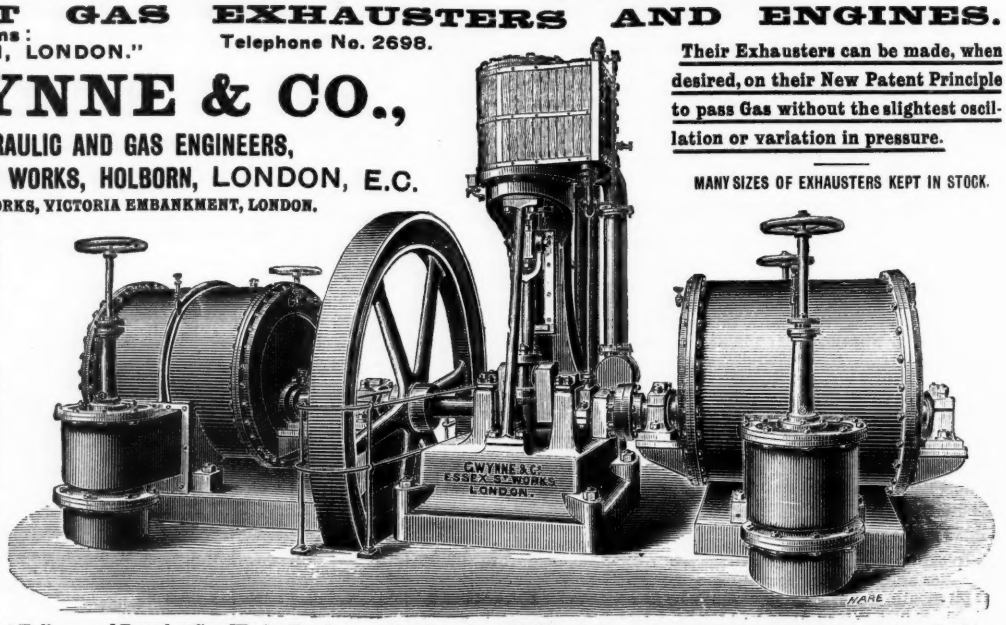

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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND Co., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

BACK-PRESSURE IN PURIFIERS.

THE Valve invented by Mr. Cripps for Bye-Passing any Layer of Purifying Material (referred to by the President of the Incorporated Institution of Gas Engineers in his Inaugural Address) can be obtained of the Makers: C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP, and J. EVERY & SON, Phœnix Iron-Works, LEWES, to which Firms all inquiries should be addressed.

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PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

WANTED, a Situation as General FITTER and INDEX TAKER. First-class Testimonials.
Address No. 2562, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas-Fitter or METER INSPECTOR. Thoroughly experienced in Main and Service Laying, inside Fitting, Stoves, Slot Meters, &c. First-class References.
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WANTED, a Situation as General FOREMAN, in a large or medium sized Gas-Works. Practically conversant with every detail of the work to be performed, and the duties required to be discharged.
Highest References and Testimonials.
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A MANAGER of a Gas-Works making 20 Million Cubic Feet per annum, desires to improve his position as MANAGER or ASSISTANT in a larger Works, either at home or abroad. Fourteen years' practical experience in every branch, including the Manufacture of Sulphate of Ammonia, and Secretarial duties. Age 30. Good Testimonials.
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WANTED, a Handy Fitter. Opportunity for energetic youth.
Apply to the MANAGER, Gas-Works, FORFAR, N.B.

WANTED, an Agent for the Sale of Gas- Retorts and Fire-Bricks, &c., in London and District.
Apply, by letter, with all particulars, to No. 2552, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Second-hand Scrubber or WASHER-SCRUBBER, having 8-inch or 10-inch Connections, to pass not less than 100,000 Cubic Feet per day; also a WASHER of similar capacity.
Give full Particulars and Price, put on Rail, to No. 2561, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RHYL URBAN DISTRICT COUNCIL.

THE Gas Committee are in want of a STATION METER, and will be glad to hear of anyone who has a second-hand one, in good order, of a capacity of from 10,000 to 15,000 Cubic Feet per hour.
Communications to be addressed to Mr. Leonard G. Hall, the Manager.
ARTHUR ROWLANDS,
Clerk to the Council.
Rhyl, Aug. 29, 1895.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
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SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office MIDDLESBROUGH. Correspondence invited.

FOR SALE—A set of Four Six-Feet PURIFIERS, in good condition.
For Price and Particulars, apply to T. G. BROWNING, Manager, Gas-Works, WHITSTABLE.

ALDERSHOT GAS AND WATER COMPANY.

TANK.

TENDERS are requested for the Ex- cavation and Building of a GASHOLDER TANK, at the Gas-Works, Ash Road, 84 ft. 3 in. diameter, by 25 ft. deep.

Specifications and Plans may be seen by applying to the Superintendent, Mr. Meiklejohn, on the Works, or Copies will be supplied to a limited number of firms, at a charge of 21s. (which will be returned on receipt of a *bonâ-fide* tender), upon application to the Chairman and Engineer, Mr. A. F. Wilson.

Tenders, endorsed "Tank," to be deposited on or before the 17th day of September, or addressed to the SECRETARY, at the Office, Victoria Road, ALDERSHOT.

CORPORATION OF LEICESTER.

SULPHURIC ACID.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply of SULPHURIC ACID, made either from Native Sicilian Brimstone, or recovered Sulphur or Pyrites.

Specific gravity in each case to be stated. The price to include free delivery by Rail into elevated tanks 27 feet high, at the Chemical Works, Aylestone Road. Probable quantity about 1200 Tons, to be delivered as required during the ensuing Twelve Months.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Acid," to be delivered at these Offices not later than 11 o'clock a.m., on Saturday, Sept. 7.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas and Electric Lighting Offices,
Millstone Lane, Leicester, Aug. 21, 1895.

GRAVESEND & MILTON GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of good GAS COALS required by them during a period of One or Three Years, to be delivered either free alongside their Wharf South Side of Canal Basin, Gravesend, or f.o.b. Vessels in accordance with their Specifications.

The Quantity required will be about 12,000 Tons per year.

Copies of the Specification and Form of Tender may be obtained of Mr. Joseph Davis, the Company's Engineer, Gas-Works, Gravesend.

Tenders to be sent in on or before Monday, Sept. 30, 1895, addressed to the Chairman, Gravesend and Milton Gaslight Company, 27, King Street, Gravesend.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
CHAS. R. GRAMSHAW,
Secretary.
27, King Street, Gravesend.

INDEX TO VOL. LX. OF "JOURNAL."

ANY Subscribers, having spare Copies of the above, can obtain 1s. each for them on application to No. 2560, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

THE Undersigned is in a position to supply, at the very lowest Prices, the most suitable kind of BENZOL for enriching Gas, made from Hardman's Patent Carbonization Process, of which I am the Sole Patentee. On application, I would furnish Price on the most reasonable terms; giving advice how to utilize it on the most economical method.
J. HARDMAN, Manufacturing Chemist.
Milton, Staffs.

TO ENGINEERS AND MANAGERS.

MR. J. L. FEATHERSTONE (late Chief Draughtsman to Humphreys and Glasgow) is prepared to supply complete WORKING DRAWINGS, SPECIFICATIONS, and QUANTITIES for WATER-GAS PLANT. Own design.
Also DRAWINGS, TRACINGS, &c., of COAL GAS PLANT; Specially prepared for work wanted in a hurry. Moderate Charges.
Temporary Offices: 27, FORE STREET, E.C.

COUNTY BOROUGH OF BRADFORD.

CORPORATION WATER-WORKS.
TO CONTRACTORS.
CONTRACT NO. 5.—NIDD VALLEY WORKS.

THE Corporation of Bradford invite TENDERS for the Construction, and Maintenance for Twelve Months after completion, of a SERVICE RESERVOIR, FILTER-BEDS, and other Works, at Chellow Heights, in the township of Heaton, in the parish of Bradford.

The Works will comprise:—

1. Masonry and Concrete Reservoir, Excavation, Earth Embankments, Clay Puddle, Upstand, Valve Chambers, &c.
2. Five Filter-Beds, having a total filtering area of 12,500 square yards.
3. Canal of Masonry and Concrete.
4. Cutting Trenches for, and Carting, Laying, and Jointing about 1700 tons of Cast-Iron Pipes, 8 inches to 36 inches diameter.
5. Formation and Construction of Sand Trap, and Screens connected therewith.
6. Forming Roads, Boundary Walls, Gateways, and Gates, &c.
7. Fitting and Fixing Valves, Gears, Sand Washers, Weirs, Appliances, and Apparatus incident to the Works.

The Drawings and Specification of Works may be seen, and copy of the Specification, with Conditions, Bill of Quantities, and Form of Tender, with reduced Drawings attached, may be obtained, at the Office of Mr. James Watson, M.Inst.C.E., the Corporation Water-Works Engineer, Town Hall, Bradford, on and after Thursday, the 22nd inst., on payment of Five Guineas, which sum will be returned in full as soon as practicable after the receipt of a *bonâ-fide* tender, with the Bill of Quantities and Schedule fully priced out.

An Assistant Engineer will meet intending Contractors at Chellow Heights Farm, on Tuesday, the 27th inst., Friday, the 30th inst., and Tuesday, the 3rd of September next, each day at One o'clock p.m., to show them over the site of the Works.

Sealed tenders, endorsed "Tender for Service Reservoir and Filter-Beds, &c.," to be sent to me, at the undernamed Office, not later than Friday, the 6th of September next.

An assurance must be given by each Contractor that he pays to the workmen employed by him not less than the minimum standard rate of wages.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
W. T. M'GOWEN,
Town Clerk.
Town Clerk's Office, Town Hall,
Bradford, Aug. 17, 1895.

NOTICES FOR POSTING IN GAS-WORKS.

CARDS suitable for Exhibiting in Gas- Works, directing Officers and Workmen to REPORT all ACCIDENTS witnessed by them, together with the Clause of the "NOTICE OF ACCIDENTS ACT, 1894," specifying the notice required to be sent to the Board of Trade, can be obtained, *price 4d. each, or 2s. 6d. per dozen, post free.*

Section 4 of the "CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875," has been similarly printed. It is required, under a Penalty of FIVE POUNDS, that a Copy of the Section shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by persons employed thereat. Copies, in large type, on broad sheets (22½ inches by 17½ inches) may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C. *Price 2s. per dozen; 10s. 6d. per 100.* On Cards the same size as those relating to the "Notice of Accidents Act," *price 4d. each, or 2s. 6d. per dozen.*

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

Winchester House, London, E.C. J. A. KELMAN.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

The LAW GUARANTEE & TRUST SOCIETY, LIMITED,

GUARANTEES FIDELITY.

Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.

HEAD OFFICE:

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY, LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

NOTICE.

The Incandescent Gas-Light Company, Limited, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

"The Incandescent Gas-Light Company Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo*, Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—

The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it, he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others*, the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.

(Signed) FAITHFULL & OWEN,
Solicitors for the Incandescent Gas-Light Company, Limited.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

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W. RICHARDSON, Fitter.

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OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

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Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

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Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.
IRONFOUNDERS,
MIDDLESBROUGH.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,
(*Established 1851,*)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

INCANDESCENT MATERIALS

OF THE VERY BEST QUALITY FOR

Lighting Power and Burning Permanence.

Recommended to Wholesale Buyers.

IN ANY QUANTITY.

Supplied by the

INTERNATIONALE GLÜHKÖRPER COMPAGNIE,
ARNHEIM, HOLLAND.

WRITE FOR SAMPLES.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ECONOMIZE £16 per RETORT per ANNUM by the USE of RETORTS of REDUCED THICKNESS fitted with

GUEGUEN'S COMPENSATING HELICOIDAL RIBS.

NO OUTLAY OF CAPITAL.
NO ALTERATION IN SETTINGS.
APPLICABLE TO ALL RETORTS.

J. LANS,
Engineer,
10, MOORGATE STREET,
LONDON, E.C.

Inquiries from Retort Makers will be Esteemed.

A FREE TRIAL FOR ALL.
Agents Wanted.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.

48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham :—

Specific Gravity (Water 1)	1·276
Weight of One Cubic Foot	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter	35·60 „
Fixed Carbon	58·80 „
Sulphur	0·96 „
Ash	1·96 „

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 „
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 „
Coke	61·05 per cent.
Ash in Coke	3·21 „
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 „
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 „

R. O. PATERSON, C.E.
Gas-Works, Cheltenham,
8th August, 1894.

For Price, &c., apply to the

Wharncliffe Woodmoor Colliery Co LIMITED,
BARNSLEY;
Or to **Mr. W. H. HARVEY,**
17, Old Queen Street, Westminster, S.W.

ENTIRELY NEW ISSUES.

NOW READY FOR 1895.

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Contains, in paragraph form, all the information formerly contained in tabular form in the Directory of Gas Companies, the Directory of Electric Lighting Companies, and the Gas-Works Statistics, together with an Index of Names.

PRICE 6s. Cloth Boards.

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Contains, in paragraph form, all the information formerly contained in Tabular form in the Directory of Water Companies and the Water-Works Statistics, together with an Index of Names.

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INVALUABLE TO ALL GAS AND WATER COMPANIES, AND THE KINDRED TRADES AND INDUSTRIES.

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TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS, STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

GAS PURIFICATION.

Best Absorbent of Sulphuretted Hydrogen, &c.

JAMES E. CAMPBELL,

Patentee and Manufacturer,
96, MILL STREET, BRADFORD, MANCHESTER.

PRICES, &c., ON APPLICATION.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON & COAL Co. Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

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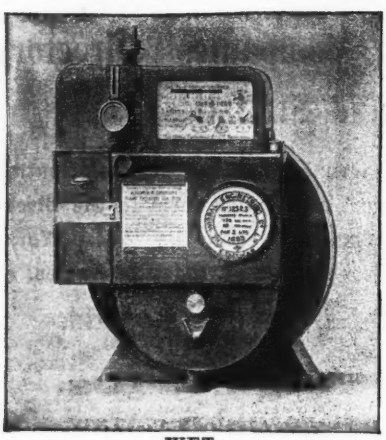

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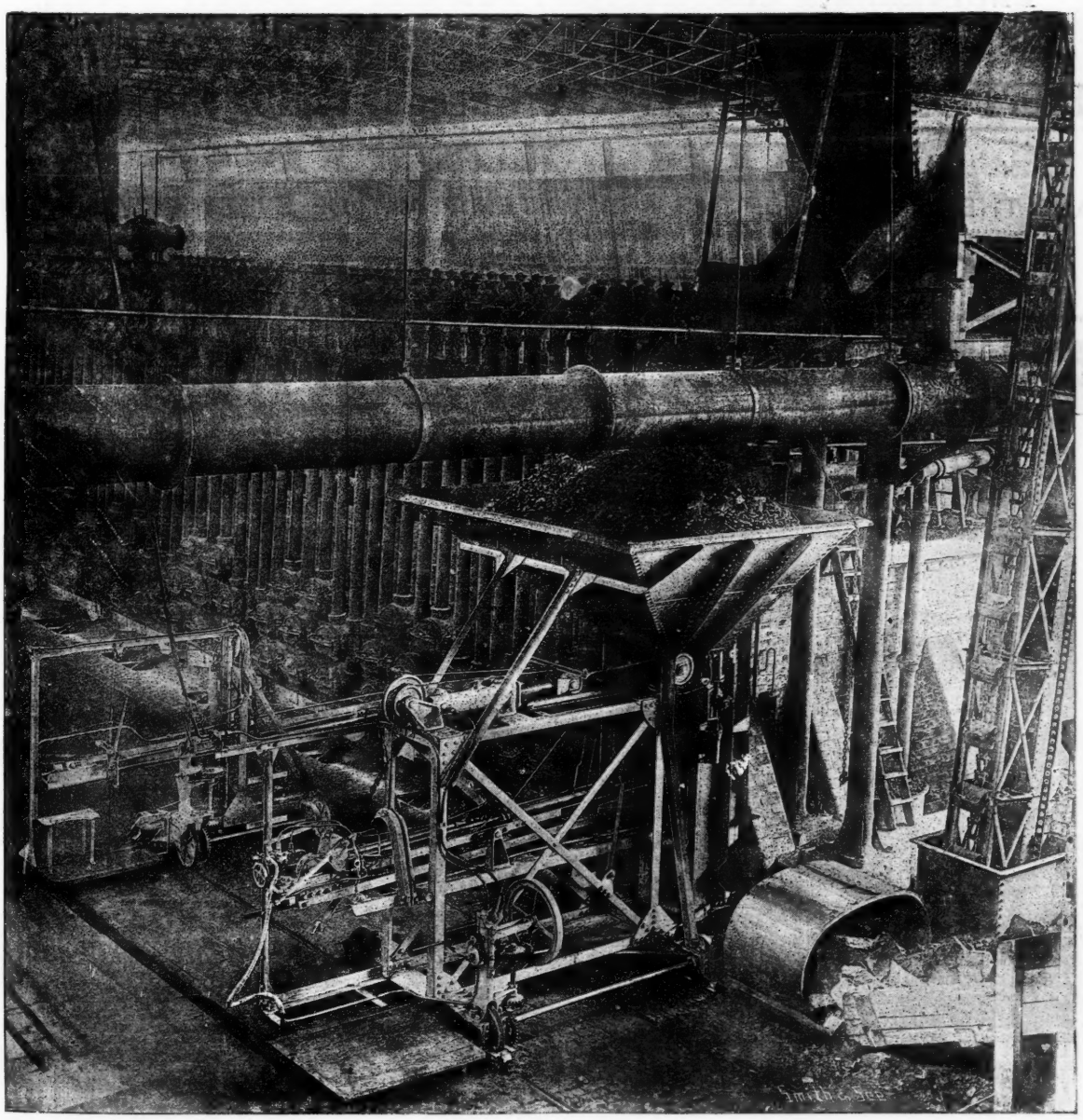

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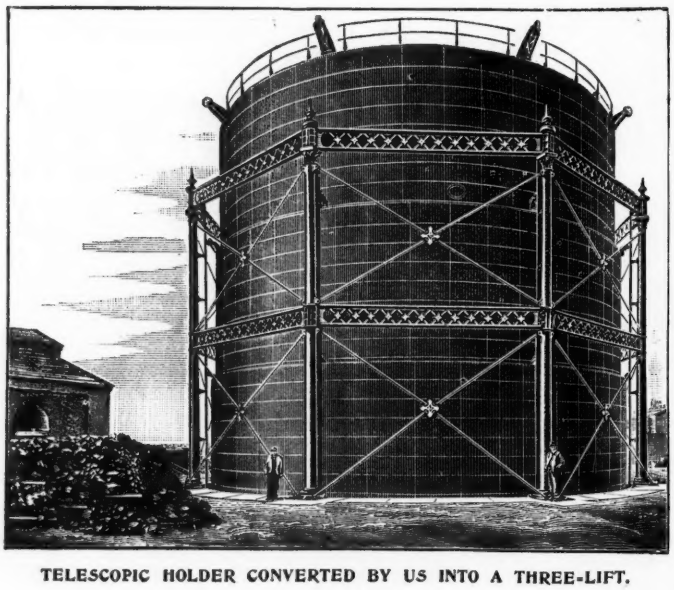

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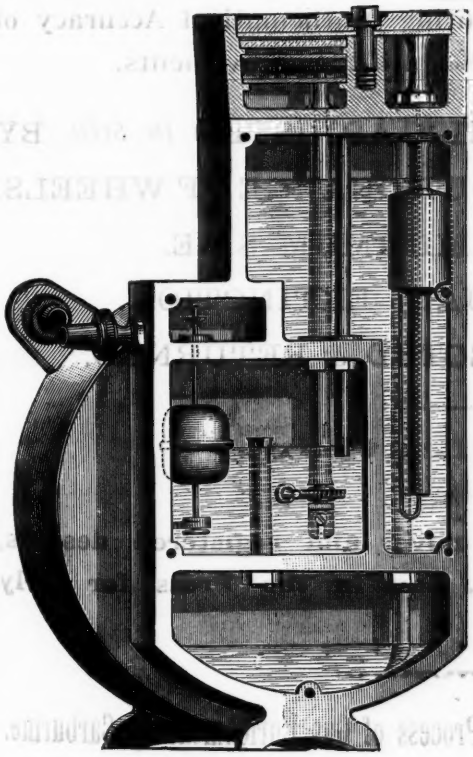

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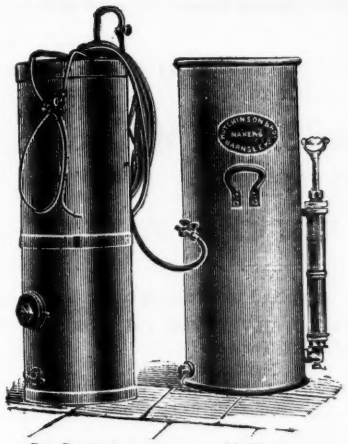

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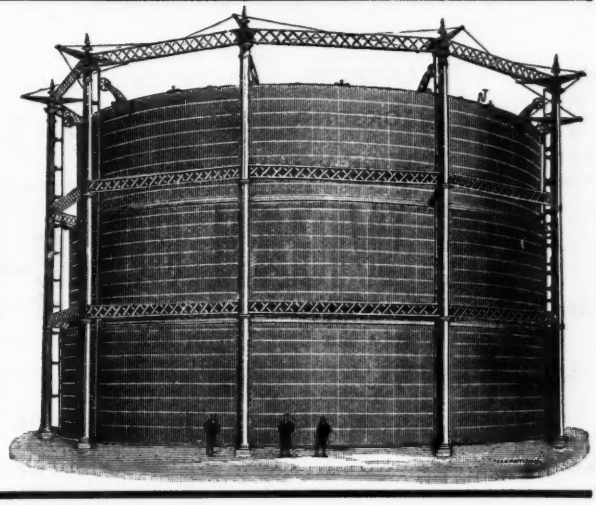

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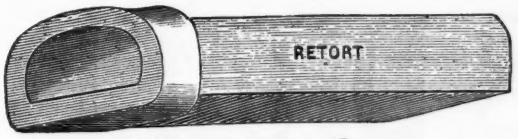

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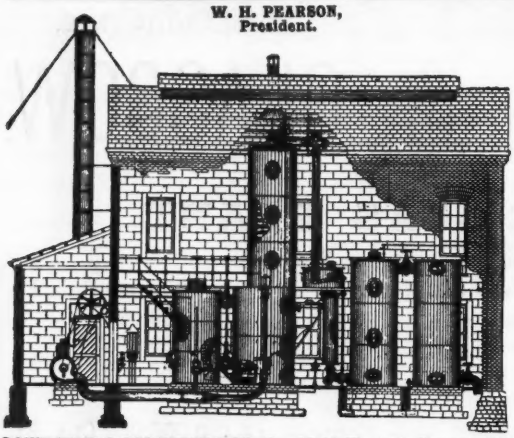

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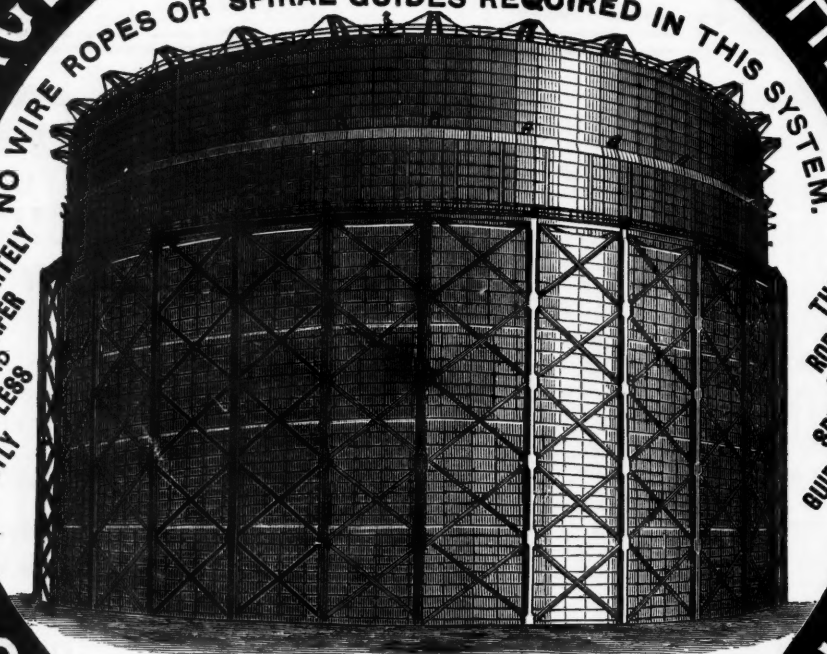

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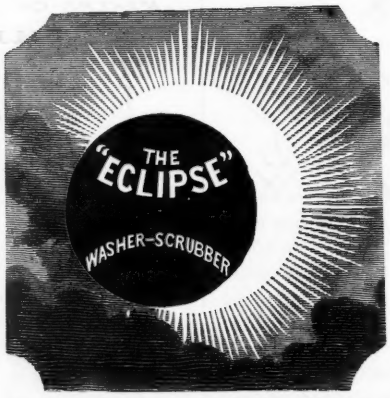

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